

Exhibit 2

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
SOUTHERN DIVISION
No. 7:23-CV-897

IN RE:
CAMP LEJEUNE WATER LITIGATION
This Document Relates To:
ALL CASES

VIDEOTAPED & VIDEOCONFERENCED DEPOSITION OF
DR. FRANK J. BOVE

Atlanta, Georgia
Thursday, October 17, 2024

Court Reporter: Michelle M. Boudreaux-Phillips, CCR

October 17, 2024

9:33 a.m.

Videotaped and videoconferenced
deposition of DR. FRANK J. BOVE, held at the
Centers for Disease Control and Prevention,
1600 Clifton Road NE, Atlanta, Georgia,
pursuant to Agreement, before Michelle M.
Boudreaux-Phillips, a Certified Court
Reporter in the State of Georgia.

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Samantha Girschick (via Zoom)
Bill Williams (via Zoom)
Deanna Havai (via Zoom)
Diana Gjonaj (via Zoom)
Mike Dowling (via Zoom)
Suzanne Yurk (via Zoom)

Videographer: Safaa Sammander

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1 THE VIDEOGRAPHER: We are now on the
2 record. My name is Safaa Sammander. I'm the
3 videographer for Golkow Litigation Services.

4 Today's date is October 17th, 2024. The
5 time is approximately 9:33 a.m. This video
6 deposition is being held in Atlanta, Georgia,
7 in the matter of In Re Camp Lejeune Water
8 Litigation. The deponent is Dr. Frank Bove.

9 Will counsel please identify yourselves
10 for the record, after which the
11 court reporter will swear in the witness.

12 MS. GREENWALD: Robin Greenwald for the
13 plaintiffs.

14 MR. VANSLYKE: Ben VanSlyke for the
15 plaintiffs.

16 MR. TELAN: Pat Telan for the plaintiffs

17 MR. LEE: Good morning. Randy Lee for
18 the plaintiffs.

19 MR. BAIN: Adam Bain for the United
20 States.

21 MS. PLATT: Elizabeth Platt for the
22 United States.

23 MS. YUEH: Lena Yueh, representing HHS.

24 ///

25 ///

1 DR. FRANK J. BOVE,
2 being first duly sworn, was examined and testified as
3 follows:

4 EXAMINATION

5 BY MS. GREENWALD:

6 Q Good morning, Dr. Bove. My name is
7 Robin Greenwald. I know we met off the record, but I
8 just wanted to introduce myself on the record, and I'm
9 one of the lawyers working on the Camp Lejeune Justice
10 Act litigation on behalf of the plaintiffs, okay?

11 Can you state your full name for the record,
12 please?

13 A Frank Joseph Bove.

14 Q Are you represented by an attorney today?

15 A No.

16 Q Did you meet with anyone from the government
17 before your deposition today?

18 A Yes.

19 Q And who was that?

20 A We had a prep meeting yesterday to go over
21 the logistics of this deposition, so there was someone
22 from -- a lawyer from the DOJ, HHS lawyers. And that's
23 basically what was discussed, you know, what kind of
24 objections you might raise, that I have to report
25 truthfully, and so on. So it was just basically going

1 over what this was going to be.

2 Q Okay. And who from the Department of Justice
3 did you meet with?

4 A I don't remember the person's name.

5 Q No one in the room right now?

6 A No.

7 Q Okay. And who from -- you said the other
8 lawyers were from HHS?

9 A Deborah Tress, Leah Yueh. I think that was
10 it. I think that's -- that's all I can recall in the
11 room. Yeah.

12 Q Okay. And what type of things did they tell
13 you that you should -- I think you said be prepared to
14 address today. Was that one of the things you said?

15 A No, no. To answer all questions.

16 Q Okay.

17 A Unless there's a -- I forget which type of
18 objective [sic], where -- a privilege objection, I
19 don't have to answer those, but you will -- I will be
20 informed which ones those are. And just going over the
21 procedure.

22 Q Okay. Did you look at any documents
23 yesterday when you prepared?

24 A I looked at documents last night when I was
25 home.

1 Q Okay.

2 A Just to refresh my memory because I -- I have
3 forgotten a lot since I retired. I put Lejeune out of
4 my mind. So I had to take a quick look at least at
5 some of the studies.

6 Q All right. Well, you've also done a lot of
7 work on Camp Lejeune, so -- and I'm going to give you
8 copies of everything today.

9 A That's good.

10 Q This is not a memory test.

11 A Good.

12 Q So maybe -- now that I've done that, let's
13 talk a little bit about depositions. I know you had a
14 meeting yesterday, but maybe we can go over a couple of
15 the rules.

16 I think you mentioned to me before we started
17 today that you've never had your deposition taken
18 before?

19 A Right.

20 Q Okay. So I guess I have the privilege of
21 being the first, and I promise I will make this as
22 painless as possible.

23 I guess the first thing I would like to tell
24 is if for any reason I ask you a question that doesn't
25 make sense or you don't understand, just please tell me

1 and I'll rephrase it --

2 A Right.

3 Q -- okay? And the other thing I want to
4 mention is this is not a memory test. If you don't
5 remember something, that's fine, and just tell me.
6 Okay?

7 A Can I ask for a document to help me --

8 Q Yeah, I was just -- you anticipated my next
9 question. So if you think a document would help you,
10 by all means let me know, and I'll give it to you if I
11 have it. If I don't have it with me, I won't be able
12 to give it to you.

13 A Okay.

14 Q Very soon, I'm going to mark many of the
15 studies that we think are relevant to today, and so
16 you'll have those at your disposal to look at as you
17 see fit. Okay?

18 A Okay.

19 Q All right. Did you ask at any point of the
20 government to pay for a lawyer to represent you today?

21 A No.

22 Q Okay. Are you testifying today as a
23 representative of the United States government?

24 A No.

25 Q Okay. And you didn't bring any documents

1 with you today --

2 A No.

3 Q -- did you? Okay.

4 I forgot to tell you one other rule we have,
5 for the court reporter's sake. So when we start
6 talking, oftentimes we'll anticipate what the question
7 is or what the answer is, and we might talk over each
8 other, and that makes it impossible for the
9 court reporter to get a record. So we should try to
10 wait until I finish the question, and I will do my best
11 to also wait until you finish the answer. Okay?

12 A Okay.

13 Q Otherwise, we'll get scolded and rightly so.

14 Okay. I think I mentioned this already, but
15 if I didn't, important for me to say it. If at any
16 time you need a break, just tell me and we'll take a
17 break. Again, you might want to stretch your legs, get
18 a glass of water, whatever. Please just tell me you
19 want a break, and we will take a break.

20 A Okay.

21 (Exhibit 1 marked for identification.)

22 (Exhibit 2 marked for identification.)

23 Q (By Ms. Greenwald) So before we get into
24 your work at -- in any detail at the ATSDR by
25 Camp Lejeune, I want to go over your background with

1 you. So I'm going to show you what's been marked as
2 Exhibit 1 and 2.

3 One is an email that I believe dates your CV,
4 and -- there's the email.

5 And then No. -- Exhibit No. 2 is your CV.

6 (Discussion off the written record.)

7 Q (By Ms. Greenwald) And here is the CV that
8 was attached to that.

9 So the email is dated January 2023. Is this
10 your CV in or around January of 2023?

11 A Yeah. Yeah, I would think so. Yeah.

12 Q Okay. And so at that time, you were still
13 working at the ATSDR; is that right?

14 A Right.

15 Q Okay. And since then, you've left the ATSDR,
16 right?

17 A Yeah. I left on June 28th. That's the
18 Friday -- the last day of the pay period.

19 Q Of this year?

20 A Yeah, this year.

21 Q Okay. So other than the -- other than the
22 fact that you're now retired from the ATSDR, is this,
23 generally speaking, an up-to-date version of your CV?

24 A Uh-huh.

25 Q Is that a yes?

1 A Yes. I'm sorry.

2 Q The other thing we have to do -- no, my
3 fault. I didn't say that.

4 A No, I --

5 Q They probably told you yesterday.

6 A Right, right.

7 Q We have to say "yes" and "no."

8 A Right.

9 Q But --

10 A Sorry.

11 Q No, no, no, no. It's okay.

12 All right. So I would like to go through
13 your CV with you, if that's okay, and tell -- let you
14 tell us a little bit about your background.

15 So you went to The Haverford School in
16 Pennsylvania. That was your high school?

17 A Yes.

18 Q I only know that's relevant because of your
19 questions that they interviewed you at some point --

20 A Oh.

21 Q -- in 2018, and we'll be going over that, so
22 that's why I wanted to mention that.

23 A Okay.

24 Q So that's your alma mater from high school,
25 right?

1 A Right.

2 Q Okay. And then you went to University of
3 Pennsylvania, and you majored in political science and
4 philosophy?

5 A That's right.

6 Q Okay. And you graduated in May of 1973?

7 A Yes.

8 Q Did you go to work straight from there, or
9 did you go straight to graduate school?

10 A I went straight to graduate -- well, I had a
11 summer job, but I went straight to graduate school.

12 Q I see you went to graduate school at
13 Boston University, in philosophy, in 1973 --

14 A Right.

15 Q -- and spent a couple of years?

16 A Year and a half -- well, yeah, two years,
17 year and a half.

18 Q And what was your study there?

19 A Well, I studied philosophy of science, I
20 studied western philosophy mostly, and some ethics, but
21 that's pretty much --

22 Q Okay. And you left before getting a graduate
23 degree from there --

24 A Right.

25 Q -- is that right?

1 A Right.

2 Q Okay. And what did you do when you left
3 Boston University?

4 A Well, the first thing I did was take a job
5 with an organization called Science for the People,
6 which is where I became exposed to environmental health
7 and occupational health issues and energy issues. And
8 they put out a bimonthly magazine. I worked for them
9 for about two years and -- I was going to say by the
10 date. They disbanded in '89. They've re -- reborn the
11 last few years and produce a bimonthly magazine.

12 Q Okay.

13 A So that's -- I worked with them for two
14 years. And then after that, I worked for the Clamshell
15 Alliance, in the Boston office. The Clamshell Alliance
16 was an anti-nuclear, pro renewable energy and energy
17 efficiency organization that was involved with an
18 occupation of the Seabrook nuclear power plant in 1977,
19 which I participated in, and other demonstrations at
20 Seabrook, New Hampshire. And then after --

21 Q Before -- I'm sorry.

22 A Yeah.

23 Q What did you do with Clamshell Alliance?
24 What was your job there?

25 A I was an organizer.

1 Q Organizer. Okay.

2 A That's pretty much what I did at Science for
3 the People, too, although I helped edit articles in the
4 magazine.

5 Q All right. And you were going to go to the
6 next job. I'm sorry.

7 A Right. I worked for the Massachusetts Public
8 Interest Research Group for a year on energy issues.
9 Near the end, they started to do some environmental
10 issues, but mostly it was energy.

11 Q Okay. And what did you do there?
12 Researcher?

13 A Research and also, again, organizing. And
14 then -- and then I worked for a Community Action
15 Agency, which is part of the war on poverty that --
16 during the Johnson era, these agencies were created to
17 work with the communities, in particular to focus on
18 low-income communities. And so there, again, working
19 as an organizer, worked on doing weatherization
20 workshops, giving weatherization kits to low-income
21 community, and then we branched out into utility
22 shutoffs, electric utility in particular, and gas, and
23 also fuel assistance where there were threats to cut
24 fuel assistance, so we were organizing around that, and
25 then public housing and tenant issues as well. So all

1 of it was focused on low-income community.

2 Q And how many years did you do that for?

3 A Let's see. Two years.

4 Q Two?

5 A Roughly, yeah.

6 Q Okay. Again, mostly organizing and then some
7 research?

8 A That one was mostly -- well, you have to do
9 some research in organizing, but mostly organizing,
10 mostly organizing.

11 Q And then --

12 A Then I went to public health school.

13 Q All right. And what was it that -- was there
14 anything in particular about the positions you held
15 after being at Boston University that drove -- that
16 spoke to you for going to public health school?

17 A Well, as I said, the Science for the People
18 job, it exposed me to environmental health and
19 occupational health. It got me very interested in
20 that, as well as energy. And I was always interested
21 in social justice issues, going back to my high school
22 days, because of the Civil Rights Movement, Anti-War
23 Movement, and so on during the '60s. So that was my
24 orientation going in.

25 So when I went to Penn and then when I went

1 to Boston University, I focused on, as I said,
2 progressive philosophy, if you will, western
3 philosophy, Hegel, Kant, and so on and so forth.

4 So -- yeah. So I think that what propelled
5 me to public health school was definitely the
6 Science for the People exposure and then being
7 interested in that, and realizing that occupation --
8 being an organizer as an occupation was going to be
9 difficult. I think I was starting to get tired, burned
10 out, as they say, and that -- and it was time to move
11 on.

12 Q Okay. I would love to talk to you about your
13 philosophy, but that's not the subject of today.

14 A Right.

15 Q So now we have to go into public health,
16 another important topic, of course.

17 And so you went to Harvard School of Public
18 Health, right?

19 A Right.

20 Q And what year did you start there?

21 A '82. So September '82.

22 Q And what degrees did you get from the
23 Harvard School of Public Health?

24 A Well, as you can see from the resume,
25 environmental health science in '84, and then I decided

1 to continue on.

2 I had a brief period working for the
3 Tufts University hazardous waste program, but then --
4 that was pretty much just the summer and part of the
5 fall, and then went back to school and got a doctorate
6 in epidemiology and also in occupational health,
7 although they call it something else. I can't remember
8 what Harvard called the occupational health degree.
9 It's something about physiology or something, but it
10 was occupational health.

11 Q Uh-huh.

12 A So that's why I put it that way. And it's an
13 Sc.D. They don't have PhDs for these kinds of degrees,
14 so there's a Doctor of Science.

15 Q Okay. And what's the -- I'm just curious.
16 Is there a difference between -- I mean, what is the
17 intersection between epidemiology and occupational
18 health? Is there one?

19 A Oh, yeah.

20 Q Yeah.

21 A Yeah. I mean, there's --

22 Q How would you describe that?

23 A Well, epidemiology is conducting studies
24 mostly. And occupational health would include
25 occupational -- industrial hygiene. It would include

1 just being -- just doing exposure assessments at
2 plants.

3 We went in, for example, to a plant where
4 they were using trichloroethylene, for example, in
5 buckets underneath their workstation, and so -- you
6 know, so we went to plants like that, went to a rubber
7 plant and so on, just to get a feel for the kinds of
8 occupational exposures.

9 Actually, I had had some experience with
10 occupational exposures in my summer jobs way back in
11 college when I worked at a shipyard in Chester and was
12 exposed to all kinds of solvents and asbestos and lead
13 and so on, while working at a summer job. So I had
14 some previous knowledge of this, although back then
15 I didn't realize how bad things were at that shipyard.
16 I didn't have any idea, in fact. But, yes, that helped
17 me understand what was going on in these plants.

18 So that's part of what occupational health
19 is, is exposure assessment, making recommendations for
20 more safety at the workplace, alternatives to using
21 toxic chemicals, and so on. So that's -- that's
22 occupational health.

23 Occupational epi would be doing studies at
24 these plants, so -- let's see if I can -- so my
25 dissertation was looking at neurological symptoms, in

1 this case, temperature and vibration sensitivity among
2 industrial painters. Solvents have an impact on
3 peripheral neuropathy, and this is an early sign of
4 that, and so -- so that's an example of occupational
5 epi.

6 Q Okay. And that's basically the --
7 essentially the field you practiced in for the 37 years
8 since you --

9 A Well, it was mostly environmental. Most of
10 the studies I've done have been environmental studies.
11 I'm trying to think of which -- if I've done any worker
12 studies since the dissertation. I mean, I look at
13 civilian workers at Camp Lejeune, but that's an
14 environmental exposure. It's not a workplace exposure.

15 Q Okay. So you're distinguishing between
16 exposures to the environment at large versus exposure
17 to chemicals in a workplace setting?

18 A Right.

19 Q Okay.

20 A So the civilian workers also were exposed
21 to -- were doing some kind of job where they were using
22 solvents or something like that. That would be a
23 workplace exposure. But drinking water exposure, I
24 would characterize as an environmental exposure.

25 Q Yeah, I was actually noticing, when I was

1 looking at your CV -- let's jump to that now -- that
2 when you go through the -- wrong document.

3 I noticed when you were referring to your
4 publications, you have quite a few, but it appeared to
5 me that 12 of them relate to drinking water
6 contamination. Does that sound about right to you?

7 A Probably, yeah, yeah. Yeah, I did a study in
8 New Jersey looking at birth defects and birth weight
9 and small for gestational age. I worked on a study on
10 leukemia and non-Hodgkin's lymphoma, as well, and
11 drinking water contamination.

12 New Jersey had a unique drinking water
13 contamination database and also had a cancer registry
14 and a birth defect registry, so that enabled us to do
15 those studies.

16 I don't know if they were really -- I was
17 hoping they would be replicated in other states, but I
18 don't think they really were.

19 And then the Camp Lejeune studies were
20 drinking water studies. And I'm trying to think were
21 there others.

22 Other studies included toxic air emissions
23 from a U.S. Air Force base in Oklahoma which impacted a
24 community right next door, a low-income community, and
25 we looked at birth weight there.

1 I was involved with the Hanford study looking
2 at iodine-131 emissions in the '40s and pre-term birth.
3 So -- and then I was also involved in a cluster
4 investigation. I was involved with an autism cluster
5 investigation in Brick Township, New Jersey. And in
6 Fallon, Nevada, a childhood leukemia cluster. So I did
7 some of that. But most of the -- mostly I did work at
8 Camp Lejeune, was the lion's share of what I was
9 doing.

10 Q And that's your time at the ATSDR, right?

11 A Yeah, all this is at the ATSDR.

12 Q Okay. Let's talk about your first job after
13 you -- let me step back for a minute.

14 When you were in graduate school, did you
15 have certain internships, like something at the
16 Massachusetts Cancer Registry?

17 A Yes.

18 Q Can you tell us about that?

19 A Yes. I was asked to investigate the
20 databases that existed in hazardous waste or any
21 other -- and the asbestos information, as well, that we
22 had, and overlay that with diseases, cancers.

23 And we -- in those days, we didn't have a
24 GIS, so it was physically overlaying a mesothelioma map
25 and -- where the school were [sic] that we knew had

1 asbestos, and we saw -- we could see a connection, but
2 we didn't do a formal study. But that was the role I
3 had there.

4 I also did an internship while at school. I
5 can't remember the program. It was part of the
6 Health Policy and Management Program --

7 Q Right.

8 A -- looking -- contacting activists across the
9 state who were dealing with toxic waste sites and doing
10 a survey, asking them how helpful was the EPA, how
11 helpful was the Massachusetts environmental agency,
12 what kinds of needs they had, and so on. So that -- I
13 wrote that up as a report. I can't remember the name
14 of the report. That's too far in the past --

15 Q Okay.

16 A -- to remember. I didn't put that in here
17 either.

18 Q I thought it was, "Research at Harvard School
19 of Public Health, Community Health Improvement
20 Program." Is that --

21 A Yes. That's good.

22 Q It is -- it is in there, from '82 to '83.

23 A Oh, it's in there? Okay.

24 Q Yep.

25 A Okay.

1 Q And then there's another one after that says,
2 "Researcher at Tufts University, Department of
3 Community Health." Was that a similar type of
4 internship?

5 A That was the toxic waste -- they were trying
6 to set up a toxic waste program -- hazardous waste
7 program. And, in fact, they came here to discuss
8 issues with Dr. Kahn, if I remember right, and -- so
9 they were trying to develop this project, and I was
10 helping them do that as a job. And I also was doing
11 some teaching assistance for the medical students in
12 epidemiology.

13 Q While you were doing your Doctor of Science?

14 A No. What I was doing that -- that brief
15 period between getting the degree in -- the master's
16 degree in environmental health and going back to school
17 was a little bit more than a four- or five-month
18 period, I think it was. So during that period.

19 Q Okay. And then the last thing I see on your
20 CV is, "Epidemiologist, Commonwealth of Massachusetts
21 Agent Orange Program."

22 A Right. That was a brief job as well. I'm
23 trying to remember what I did there. I think it was
24 looking over surveys of veterans who were exposed or at
25 least thought they were, you know, in Vietnam. I can't

1 recall exactly what that work was --

2 Q Okay.

3 A -- but that was -- yeah.

4 Q All right.

5 A It's too long ago for me to remember now.

6 Q So your first job, if I'm correct, after you
7 finished your Doctor of Science, was as a research
8 scientists at the New Jersey Department of Health?

9 A Yeah, I actually started there before I
10 finished the doctorate.

11 Q Okay.

12 A Yeah, so 1986 I started work at New Jersey,
13 finished my doctorate while I was there.

14 Q All right. And what did you do -- you were
15 there until 1991, so about five years; is that right?

16 A Yes. Yeah.

17 Q What kind of work did you do, generally, when
18 you were there?

19 A Well, I did these drinking water studies I
20 was mentioning --

21 Q Right.

22 A -- looking at birth defects and small for
23 gestational age and pre-term birth and -- and that
24 hadn't been done before. In particular, I was able to
25 link a disinfection byproduct called trihalomethanes

1 and small for gestational age, neural tube defects,
2 oral clefts. And that was unique and caused a lot of
3 stir because we knew -- or we -- we had some experience
4 with cancer and these contaminants, but no one had
5 looked at birth outcomes before.

6 And so, as I said, it did raise a lot of
7 interest at EPA. There was a conference I remember the
8 ILSI, I-L-S-I, put on where they sort of questioned me
9 on the study, you know, and I had to defend the study
10 and so on.

11 So it had that big of an impact. And it
12 also, I think, encouraged the EPA to do some research
13 looking at neural tube defects and the trihalomethanes
14 and the other disinfection byproducts. So that was a
15 good outcome of --

16 Q That's a great outcome.

17 A Yeah. So that was the key one. I also, as I
18 said, worked on a leukemia and non-Hodgkin's lymphoma
19 study, again, with drinking water.

20 Q Do you remember what the chemical was?

21 A The chemicals in the drinking water that were
22 in the database that was the focus of the study was
23 trichloroethylene, perchloroethylene, vinyl chloride,
24 benzene, and 1,2-dichloroethylene.

25 Q So similar to the contaminants at

1 Camp Lejeune?

2 A Right. But they -- you know, we -- I think
3 that that -- those were the chemicals that people were
4 most concerned about, going back to the 1980s. And
5 trihalomethanes, as I said, they were the other -- that
6 was a different database in New Jersey, but I decided
7 to -- I was asked -- I was tasked by -- actually, it
8 was a cooperative agreement from CDC/ATSDR to look at
9 toxic waste sites and birth defects. I did try to do
10 that, but the data from the remedial investigations
11 from our health surveys were not -- the health
12 assessments were not good enough to do a really good
13 study.

14 So I focused on the drinking water data that
15 New Jersey had, which was the best in the country.
16 And those were the chemicals -- TCE, PCE,
17 1,2-dichloroethylene, vinyl chloride -- were the ones
18 that they covered, and then there was a separate
19 database on trihalomethanes.

20 I decided to include the trihalomethanes in
21 the study, just because it was there, and didn't expect
22 to see anything. And that's the contaminants that had
23 the strongest findings. And so that -- as I point out
24 to people all the time, you never know what you're
25 going to get in a science study, and sometimes the

1 unexpected happened.

2 In this case, I had no idea I would see
3 anything with trihalomethanes, and it was there. I did
4 see something with trichloroethylene. I think the
5 problem there was just not enough numbers of people or
6 populations exposed to get a strong finding. And also,
7 birth defects are rare, and so you have small numbers
8 to start with.

9 So, you know, it was hard to interpret those
10 studies to some extent, but I did see something with
11 trichloroethylene and perchloroethylene and benzene.

12 Q Okay.

13 A Yeah.

14 Q And I think you mentioned this, but I was
15 just going to ask you. I see it in your -- when you
16 were describing your job with New Jersey, that it was a
17 cooperative with the -- cooperative agreement.

18 Was that the entire time -- it says,
19 "Responsibilities: Co-principal investigator on a
20 5-year cooperative agreement with ATSDR/CDC."

21 A That was pretty --

22 Q Was that the entirety of your job there, or
23 were there other parts of your work with New Jersey?

24 A That was most. I mean, I think my salary
25 came out of that, pretty much.

1 Q Okay.

2 A But I did do a land -- there was this study I
3 was involved with looking at birth outcomes around a
4 landfill that was one of the major landfills in the
5 country called Lipari Landfill. I think -- that was
6 one of the landfills that pushed Lautenberg to push for
7 a superfund, along with Love Canal.

8 And so we did see small for gestational age
9 in a small ring around the landfill. So, again, that
10 was the first time that that was done. So we were able
11 to do a lot of initial work on these things because of
12 the data we had in New Jersey.

13 Q Just a couple of other quick questions here.
14 Were you also an adjunct faculty member at Drexel?

15 A Right. I think I did that only one year --

16 Q Uh-huh.

17 A -- teaching medical -- was that the -- yeah,
18 I think that was the medical students.

19 Q You say --

20 A Oh, no. I'm sorry. That wasn't medical
21 students. That was graduate students, I think, and --

22 Q Department of Environmental Engineering?

23 A Yeah, and I was teaching them epidemiology.
24 And all the -- all the teaching, I'm teaching
25 epidemiology.

1 Q Okay.

2 A Okay. So I was -- later, I did a -- taught
3 in India, for example, epidemiology to doctors there.
4 So the doctors I taught, that was at the -- Tufts,
5 right. And the Drexel was the, right, as you said,
6 engineers.

7 Q Okay. So after your five years at New Jersey
8 Department of Health, you joined the ATSDR; is that
9 right?

10 A Right.

11 Q And what position did you join the ATSDR as?

12 A I started out as a senior epidemiologist and
13 stayed a senior epidemiologist the whole time.

14 Q So when you left, what, 32 years later --
15 were you with ATSDR for 32 years?

16 A Almost 33.

17 Q Almost 33?

18 A Yeah.

19 Q So for 33 years, you were a senior
20 epidemiologist for the ATSDR?

21 A Right.

22 Q Well, we thank you for your service.

23 Okay. So let's just do a little high level
24 now about your time at ATSDR because, obviously, we're
25 going to focus on Camp Lejeune --

1 A Right.

2 Q -- at this deposition. I just wanted to get
3 a background in epidemiology first before we dive into
4 some of this --

5 A Okay.

6 Q -- information on Camp Lejeune. And I also
7 wanted to mention -- that I forgot at the beginning, is
8 that we're in Phase 1 of the litigation, so the focus
9 is going to be on five diseases today. We're not going
10 to go into birth defects today because it's not part of
11 Phase 1. So it's, just so you know -- I think you
12 might know this already, but just in case, it's kidney
13 cancer, bladder cancer, non-Hodgkin's lymphoma,
14 leukemia, and Parkinson's disease. So that's going to
15 be the focus today, and not even much on that
16 specifically, but I won't be going into birth defects
17 much in detail. While I know you've done a ton of work
18 on that, it won't be today. I just wanted to mention
19 that.

20 So with that prelude, I wanted to just have
21 you give sort of a high level, as we start out, about
22 your job at the ATSDR over the almost 33 years.

23 A Okay. It's the Agency for Toxic Substances
24 and Disease Registry. It's part of the Centers for
25 Disease Control.

1 Initially, I was still finishing up some work
2 on that drinking water study in New Jersey. I did a
3 little bit of additional analyses and wrote a journal
4 article. So that was one thing.

5 But the main reason -- my main job at the
6 beginning was this hazardous waste workers surveillance
7 project, which entailed surveying hazardous waste
8 workers who were part of the Laborers' International
9 Union of North America, LIUNA, and working with that
10 union to serve hazardous waste workers.

11 And we did one survey, and then we -- I guess
12 it must have been a year or two later, we did another
13 survey asking about, you know, the job they were doing,
14 also what kinds of exposures they think they had and
15 any -- I'm pretty sure there was some health -- yes,
16 there definitely was some health component, as well, in
17 the surveys.

18 That didn't -- that wasn't as successful a
19 project. I think partly because when you do a survey,
20 it's very difficult to get a good participation, and I
21 think that that was the major problem. Even though we
22 worked with the union, we didn't get a high percentage
23 of workers participating.

24 Q Just generally speaking, how would you
25 distinguish a survey that you just mentioned, that type

1 of study, from the kind of cohort study that I know
2 you've done many of while you're at the ATSDR -- while
3 you were at the ATSDR?

4 A Well, a survey could be -- you can survey a
5 cohort --

6 Q Right.

7 A -- and that's -- a survey is like we did with
8 the birth defect study at Lejeune, where we first try
9 to find out who has a birth defect. There was no birth
10 defect registry. The only way to approach that was to
11 survey the families. And we were lucky to have some
12 information on the birth certificate to help us that
13 way, and there was also some hospital records that
14 helped us identify the people who had been on base and
15 gave birth, and then there was word of mouth. So you
16 had that group of people.

17 We did a phone survey, which is just asking
18 questions --

19 Q Right.

20 A -- you know, did you -- you know, who you
21 are, when were you on the base, and did your child have
22 a cancer or birth defect. Okay? So that's a survey.

23 And then we surveyed them again, those people
24 who we had medical records on that confirmed that they
25 had the birth defect we were interested in, which was

1 neural tube defects and oral clefts. We would -- we
2 did a, again, phone interview to get additional
3 information.

4 So that is a survey, but you could call it a
5 cohort study as well. So any time you use a
6 questionnaire or do interviews, I would call that a
7 survey.

8 Q Okay.

9 A And the question is what's the -- you know,
10 one of the questions of a survey is how many people
11 participated, what's the percentage.

12 Q Right.

13 A Right.

14 We did a survey later on trying to survey
15 Marines, Navy personnel, and civilian workers at
16 Camp Lejeune. And, again, we sent -- that was a mail
17 survey, so we sent out a survey to everybody, hundreds
18 of thousands of people. But the participation rate
19 there was around, which you would expect these days,
20 about 30 percent. So that's a survey.

21 Q Uh-huh.

22 A You can -- for an occupational study, you
23 would want to use plant records to identify the
24 workers, you would have plant records on what kinds
25 of -- what jobs they had. You had maybe some

1 information on what chemicals are used in those jobs,
2 so you have -- that's on the exposure side. And you'd
3 either have -- you would have medical records from the
4 plant. Or if you did a cancer incidence study, you
5 might use a cancer registry to help you do that and so
6 on. So that's a different kind of study altogether.

7 So if you use hard data, let's say, if you're
8 not doing an interview but you're basing it on data
9 that you obtained, maybe you -- you test people. You
10 can test people, like I did in my dissertation, where I
11 tested these painters for vibration and temperature
12 sensitivity, and there were other tests being done at
13 the same time looking at neurobehavioral problems. So
14 that's -- that's a study; that's not a survey.

15 Q Okay.

16 A So that's how I distinguish it.

17 Q That's really helpful.

18 And is it fair to say that the number of
19 participants you have in a study is relevant to the
20 power of that study, typically?

21 A Oh, sure.

22 Q Okay.

23 A Sure.

24 Q And so the lower the participants, the weaker
25 the results?

1 A Well, also you have to worry about bias.
2 It's not just a power issue. You have to worry about
3 selection bias, who -- or volunteer bias, whatever you
4 want to call it, why these people and not others, was
5 it because they were already sick and they wanted to be
6 in this and the people who weren't sick didn't
7 participate. You have to deal with issues like that,
8 and sometimes you don't have information to tease out
9 how bad the bias might be, so...

10 Q All right. So let me mark your -- some of
11 the studies that you may or may not want to refer to
12 over the course of the deposition today.

13 I am going to mark first as Exhibit 3 your
14 "Evaluation of mortality among Marines and Navy
15 personnel exposed to contaminated drinking water at
16 USMC Base Camp Lejeune: a retrospective cohort study."

17 A Right.

18 Q That's No. 3.

19 A Uh-huh.

20 (Exhibit 3 marked for identification.)

21 MS. GREENWALD: No. 4 is going to be the
22 "Mortality study of civilian employees
23 exposed to contaminated drinking water at
24 USMC Base Camp Lejeune: a retrospective
25 cohort study."

1 (Exhibit 4 marked for identification.)

2 MS. GREENWALD: The next one is -- 5 is
3 the "ATSDR Assessment of the Evidence for the
4 Drinking Water Contaminants at Camp Lejeune
5 and Specific Cancers and Other Diseases."

6 THE WITNESS: Right.

7 MS. GREENWALD: That's a big one.

8 (Exhibit 5 marked for identification.)

9 MS. GREENWALD: Exhibit 6 is "Evaluation
10 of mortality among Marines, Navy personnel,
11 and civilian workers exposed to contaminated
12 drinking water at USMC Base Camp Lejeune: a
13 cohort study," of 2024.

14 THE WITNESS: Right.

15 MS. GREENWALD: This is the updated
16 one.

17 THE WITNESS: Right.

18 (Exhibit 6 marked for identification.)

19 MS. GREENWALD: And last, but not least,
20 is the cancer incidence study. So this is
21 the "Evaluation of cancer incidence among
22 Marines and Navy personnel and civilian
23 workers exposed to contaminated drinking
24 water at USMC Base Camp Lejeune: a cohort
25 study," and this is also 2024. That's No. 7.

1 THE WITNESS: Uh-huh.

2 (Exhibit 7 marked for identification.)

3 Q (By Ms. Greenwald) I just wanted to give you
4 those so you can have them to refer to at any time you
5 want. Okay?

6 A Uh-huh.

7 Q And, again, as I said earlier, anything else
8 you might want to look at, just ask me for it; and if I
9 have it, I'll give it to you.

10 I just want to ask some preliminary
11 questions. You're the primary author on the documents
12 I just gave you, Exhibit 3 through 7, right?

13 A Well, the first or second author.

14 Q Okay.

15 A But I -- yeah, I directed -- I wrote the
16 protocol for all of them.

17 Q And that pretty much defines a lot of your
18 life's work at the ATSDR; is that fair?

19 A Uh-huh.

20 Q So I want to go over a couple of awards you
21 got relating to some of the work you did. So I want to
22 show you what I'm going to mark as Exhibit 8.

23 (Exhibit 8 marked for identification.)

24 Q (By Ms. Greenwald) Do you recall receiving
25 the Ozonoff Award for your studies at Camp Lejeune?

1 A Yes.

2 Q So congratulations on this.

3 Here is the notice that appears on the
4 Boston University School of Public Health.

5 A Uh-huh.

6 Q What did you receive that award for?

7 A Well, I received it for both the research I
8 did at Camp Lejeune up to that point, which was the
9 mortality studies, the birth defect studies, and the
10 birth weight studies, as well as my work with the
11 community assistance panel at Camp Lejeune, working
12 closely with them on a number of issues, trying to work
13 with them to get presumption. I mean, that was
14 something that we were thinking about way back,
15 actually, as the only real solution to this problem.
16 My agency pretty much agreed with that. That wasn't
17 just my opinion. And, you know -- but we didn't know
18 how to get there. So we were hoping the studies might
19 help push that, but we gave as much -- I gave as much
20 information I could on health effects and coached the
21 CAP on that. And so they were able to do the lobbying
22 necessary to actually get that to happen.

23 So I think that both those things, my work
24 with the CAP and my research, they decided to give me
25 the Unsung Hero Aware. They also knew that I had some

1 difficulties within the agency at points, and also
2 dealing with the Navy, on getting these studies to
3 happen.

4 I think the -- the NRC report in 2009 was
5 used, to some extent, by -- well, used by a great
6 extent by the Marine Corps and Navy, and to some extent
7 within my agency, as a reason maybe we shouldn't go any
8 further on these studies.

9 And in particular, after the mortality
10 studies were done, the next step, which would be a
11 cancer incidence study -- I mean, we did a male breast
12 cancer study, but that was pretty easy to do using VA
13 data, so that wasn't a concern.

14 The survey, we were forced to do by Congress,
15 and the -- but they did not want internally -- and
16 also, definitely the Navy and Marine Corps were not
17 interested in a cancer incidence study. Everyone
18 thought it was going to be too expensive.

19 So they knew I was battling on that issue,
20 and I think that was part of the reason for the
21 award.

22 Q Okay. Can we -- let's -- there was a lot in
23 that answer that I would love to explore with you.

24 A Okay.

25 Q I was going to do it later, but let's do it

1 now.

2 Let's go to the CAP, and then we'll go to the
3 NRC. So the NRC report is the report in 2009 that
4 evaluated the ATSDR's ability to really do the kind of
5 studies that you wanted to do; is that fair?

6 A Yes.

7 Q Okay. There was a lot of controversy about
8 that report, wasn't there?

9 A Yes.

10 Q Okay. I have some documents to show you
11 about that, but we'll wait a little bit on that. But I
12 would like to talk to you about the CAP because I know
13 that is an important part of your work at the ATSDR and
14 just generally as an epidemiologist.

15 So explain a little bit about how that CAP
16 program -- how you were a part of -- that CAP program
17 become [sic] part of the ATSDR generally and
18 specifically for Camp Lejeune.

19 A Well, I always think that it's important for
20 a community to be involved in the science as much as
21 possible, either giving us direction by telling us what
22 their health concerns are or what other concerns they
23 have or that they want the research to meet. That
24 would include health assessments too. I feel that
25 there should be CAPs for that too, but that hasn't

1 happened in the agency.

2 It is time-consuming to develop a CAP, who's
3 going to be on it, who isn't.

4 I worked on one CAP that was in Cape Cod,
5 Massachusetts, around the -- it used to be Otis Air
6 Force Base. I can't remember what it's called now.
7 That CAP was very controversial. There was a lot of
8 animosity between a few CAP members and the agency, and
9 everybody else, for that matter. And because of my
10 organizing experience, I went there and tried to calm
11 the situation down and work with them more closely to
12 get what they wanted done. And it benefited both --
13 everybody, I think.

14 So I was not going to do any work on
15 Camp Lejeune without having a CAP in place. I made
16 that clear to the agency. There was some, again, you
17 know, resistance because it does take work to develop a
18 CAP.

19 Q So why did you feel that you couldn't and
20 wouldn't do any work at Camp Lejeune without a CAP?

21 A Because I thought that it was important for
22 the affected community to have some say and input. We
23 did have a meeting that was required by Congress to
24 look at endpoints other than childhood endpoints, so
25 look at adult endpoints. That meeting was in 2005 or

1 before that. I'm trying to -- I can't remember the
2 exact dates.

3 At that meeting, I talked to the two
4 co-chairs and said, "If you can do anything, push for a
5 CAP." And they did. And because they pushed and
6 because I was pushing internally, a CAP was formed.

7 Q And the ATSDR eventually embraced the concept
8 of a CAP, correct?

9 A Well, they embraced the concept of a CAP
10 before that. It's just that -- you know, we're
11 involved in thousands of sites. You can't set up a CAP
12 on every site, so which ones do you choose, I think
13 that was one problem. And it's difficult, who's going
14 to be on the CAP, who isn't. We had a bad experience
15 with the Cape -- I didn't have a bad experience, but
16 the agency had a bad experience -- so did the health
17 department -- had a bad experience in the Cape Cod CAP,
18 so -- so there's those reasons. So it's not automatic.

19 But the agency pretty much thought it was
20 important, and they -- you know, they had no problem
21 with the Camp Lejeune CAP once the science panel made
22 that recommendation.

23 Q Okay.

24 A It went quickly to set it up.

25 Q And that was, like, in 2005, right, that the

1 science panel recommended that?

2 A Yeah, I think -- yeah, it's in the website.
3 I think it's 2005. And so the CAP must have started in
4 2006. I think that --

5 Q I have the document from 2005 here somewhere.

6 A Yeah, I'm trying to remember exactly, but
7 that's roughly.

8 Q So can you just say -- so what is a CAP? I
9 mean, if you can describe that in your words what a CAP
10 is.

11 A Well, it's supposed -- a CAP, a community --
12 we call it a community assistance panel because it's
13 not an advisory panel --

14 Q Right.

15 A -- so it doesn't follow the advisory panel
16 laws or regulations. So it's an assistance panel.
17 It's named that way for that reason.

18 So there wasn't a need to have a vote on
19 stuff. We did have votes, but just to get a sense for
20 the meeting. But it didn't require those kind of
21 rules, it -- who was on the CAP, in this case -- you
22 know, you do different things in different communities.
23 In this case, there were two groups already formed on
24 Camp Lejeune, either dependents or Marines who were
25 there during the contamination. So we just asked both

1 groups to nominate four people, I think it was. So
2 that's how we formed the Lejeune CAP. I'm not sure how
3 the other CAPs are formed.

4 The CAP I helped form at New Hampshire for
5 the Pease PFAS study -- I did work on other things.
6 That's why I'm --

7 Q I saw that.

8 A Not just Camp Lejeune.

9 That one, we asked both -- there were three
10 activists already, and we asked them to nominate other
11 people, we brought scientists in there as well, and
12 formed that CAP a little differently than the Lejeune
13 CAP.

14 So it really depends on the community, so --
15 and we use the CAP, if you will, to explain what we are
16 thinking about doing, explain the studies if we are
17 going to do one, and have the CAP -- in an ideal
18 situation, have the CAP have input into how that study
19 is designed or what kinds of endpoints we look at, how,
20 you know -- and in this case, the Camp Lejeune CAP was
21 crucial because -- for science information, because
22 they knew, and the Marine Corps apparently didn't know,
23 where barracks were placed on base, where units were
24 barracked on base. And we relied on CAP members plus
25 people they knew who had that memory, for example.

1 So there were -- and also, we wouldn't have
2 done, I think, a male breast cancer study because --
3 wouldn't have even thought of doing it, but we did
4 because the CAP had done its own research, identified a
5 lot of male breast cancer cases, made a big public, you
6 know, media thing about it. And we said yes, good
7 idea, we'll pursue it. At least initially, using VA
8 data, which is limited, we had small numbers, but it
9 was a first look, and we were certainly going to
10 include it in any cancer incidence study or mortality
11 study to the extent we could look at it.

12 Q Okay. So -- I think, if I understood your
13 answer, so the CAP is sometimes populated by people who
14 have been active, and you ask them to nominate people
15 to be on the CAP; is that right?

16 A Well, the CAP should be representative -- I
17 mean, the idea is to have it representative of the
18 community and also have -- like I said, in Boston, have
19 the health department involved, any other relevant
20 agency also involved.

21 So the Camp Lejeune CAP, the relevant parties
22 would have been a representative from the Marine Corps,
23 which they did send for the early days of the CAP. And
24 that was it. There wasn't -- we didn't really have a
25 health department. We were the health department,

1 so -- so that was a little different.

2 Other -- there are a few other CAPs that
3 would involve the health department serving the area
4 where the site was.

5 Q So how many members was the CAP for the
6 Camp Lejeune work?

7 A It varied. I'm trying -- we had eight at one
8 point. It went back and forth. You know, I'm also
9 confusing it with the Pease CAP. We had a lot more
10 there, so I -- but roughly eight or nine. You could
11 tell from the transcripts.

12 Q So you had more on the Pease, you said?

13 A The Pease CAP was much bigger, yes. Yeah. I
14 think because we included the scientists. We didn't
15 really count the scientists. There were two technical
16 people for the CAP, and we asked the CAP to -- well, we
17 helped the CAP come up with who those people were that
18 would be helpful.

19 Q Okay.

20 A And at Pease, there were a number of people
21 we wanted, because it was a new substance and new
22 effort, really.

23 Q Okay. We got on that discussion over your
24 Ozonoff Award. Let me ask you a couple of other
25 background questions before we talk about some of these

1 studies.

2 So are you aware -- do you know about the
3 American College of Epidemiology?

4 A Well, I've heard of them, yeah.

5 Q You're not a member?

6 A No.

7 Q Were you ever a member?

8 A No.

9 Q As a government employee, were you allowed to
10 be members of those kind of organizations? I know some
11 government rules have --

12 A I think we were. I just didn't join.

13 Q Okay.

14 A I haven't been -- I don't think I've -- at
15 one point, I think I was a member of the APHA, American
16 Public Health Association, briefly because I had to in
17 order to do a speaking engagement at their convention.

18 Q Okay.

19 A But I tried not to be involved in those. My
20 focus was on the work, and so I didn't join any of
21 these organizations.

22 Q Okay. I want to show you a couple of
23 exhibits that talk about just some of the views of the
24 American College of Epidemiology to see if you agree
25 with them. So 9 is their mission and vision.

1 (Exhibit 9 marked for identification.)

2 Q (By Ms. Greenwald) And then I'm just going
3 to go over some -- a couple of the guidelines with you.
4 That will be Exhibit 10.

5 (Exhibit 10 marked for identification.)

6 Q (By Ms. Greenwald) And here's the
7 guidelines. I'm just going to ask you if you agree
8 with some of these views of epidemiology generally.

9 So if you look at the vision on page 2, it
10 says, "We envision a world where the value of
11 epidemiology in public health is universally
12 recognized, driven by a community dedicated to
13 education, innovation, and transformative research."

14 Would you agree that that's a vision that
15 epidemiologists --

16 A I think that's a --

17 Q -- would embrace?

18 A -- good mission. To me, an epidemiologist
19 needs to be a public health -- have a public health
20 perspective, and that sounds like what they're saying
21 here.

22 Q Exactly. So I'm going to go to the
23 guidelines, because I think that's probably the most
24 relevant, then, based on what you just said.

25 A Is that 10?

1 Q That's Exhibit 11.

2 A Oh, Exhibit 11.

3 Q No, 10. I'm sorry.

4 A Ten. Okay. I was going to say --

5 Q You're absolutely right.

6 So if you look at the -- on page 3 of
7 Exhibit 10, at the bottom, under "Core Values, Duties,
8 and Virtues in Epidemiology." Do you see that? It's
9 at the bottom of page 3.

10 A Well, it's not numbered, so I'm trying --

11 Q Oh. On the top -- there's no number in the
12 top left?

13 A Oh, maybe there -- oh, here it is, "Page 3."
14 I'm sorry, I didn't see --

15 Q Oh, no, no, no.

16 A Core values.

17 Q It's because the paper clip is in the way.

18 A Right. Sorry.

19 Q It says, "In this section we define and
20 discuss core values, scientific and ethical precepts
21 widely held within the profession, as well as duties
22 and virtues in epidemiology. We also relate core
23 values to the mission of epidemiology: the pursuit of
24 knowledge through scientific research and the
25 improvement of public health through the application of

1 that knowledge."

2 So you would agree with that statement --

3 A Yes.

4 Q -- right?

5 A Yes.

6 Q Okay. And there's a number of those
7 throughout here. I'm going to jump -- I don't want to
8 waste -- I don't want to spend too much time on this so
9 we can make this as short as possible for you.

10 A Uh-huh.

11 Q If you can go to page 6, under "Providing
12 Benefits." Do you see that?

13 A Uh-huh.

14 Q "Epidemiologists should ensure that the
15 potential benefits of studies to research participants
16 and to society are maximized by, for example,
17 communicating results in a timely fashion. Steps
18 should also be taken to maximize the potential benefits
19 of public health practice activities."

20 Would you agree with that?

21 A Yes. And I think that that's why a CAP is
22 important, just for these reasons, to make sure that we
23 can communicate to the community and have the CAP do
24 that for us, and also to make sure that what we're
25 doing is useful to that community.

1 Q And the timely communication is important as
2 well, right?

3 A Well, that's what I mean, yeah, yeah.

4 Q And then apropos to what you're saying, on
5 page 8, 2.8.2 talks about "Involving community
6 representatives in research." And that's, again,
7 something you strongly agree with, right?

8 A Yes.

9 Q Okay. So right under that, it says,
10 "2.9 Avoiding Conflicts of Interest and Partiality -
11 Epidemiologists should avoid conflicts of interest and
12 be objective. They should maintain honesty and
13 impartiality in the design, conduct, interpretation,
14 and reporting of research."

15 You would agree with that --

16 A Yes.

17 Q -- also, right?

18 A Yes. Sure.

19 Q And they're not inconsistent, correct?
20 Involving the community isn't inconsistent with 2.9, is
21 it?

22 A Well, it depends on how you define "conflict
23 of interest." My view is that you're supposed to serve
24 the -- especially government workers -- supposed to
25 serve the public.

1 So working on promoting public health would
2 not be a conflict of interest if you work with the
3 community. That's the whole point of promoting public
4 health, is working with communities to enhance their
5 health. So some people do see that as a conflict. I
6 don't.

7 Q But -- yeah, I think -- so here -- let me
8 step back and ask it a different way.

9 A Uh-huh.

10 Q Your involvement with a CAP in any of your
11 projects, from the time you've been an epidemiologist
12 until the time you retired a couple of months ago, you
13 would never have had that involvement impact the
14 design, conduct, interpretation, and reporting of your
15 research, right?

16 A No.

17 Q I'm just trying to save time here, so give me
18 one second.

19 Okay, so if you go to page 13, the first
20 full -- the second paragraph. I'm sorry.

21 "The potential benefits of epidemiologic
22 research include providing scientific data that
23 policymakers can use to formulate sound public health
24 policy. The responsibilities of epidemiologists to
25 facilitate the development of health policy include

1 publishing objective research findings in a form that
2 can be utilized by policymakers. The publication of
3 both positive and negative research findings is
4 important, since it helps to prevent publication bias
5 and allows for additional benefits to be gleaned
6 through meta-analyses."

7 You would agree with that --

8 A Yes.

9 Q -- right?

10 A Yes.

11 Q And then I -- we've talked about this a fair
12 amount. 3.8 talks about maintaining public trust. On
13 page 19. I'm sorry. On page 19. And over on page 20,
14 it says, on the first full paragraph, "Maintaining
15 public trust is especially important in planning and
16 carrying out community studies. In identifying public
17 health problems to be studied, and their priority for
18 study, epidemiologists should take into account the
19 perceived importance of the problem to the people
20 living in a community after information about the
21 problem has been provided. However, if epidemiologists
22 perceive that a health problem exists but is being
23 ignored or its existence denied by the community, it
24 may well be appropriate to proceed with a study of a
25 health problem (or an outbreak investigation that must

1 be initiated without delay to address an urgent public
2 health concern) while simultaneously working with the
3 community to gain their confidence and support."

4 You would agree with that --

5 A Yes.

6 Q -- right?

7 A Yes.

8 Q Okay. I think we can put this one aside.
9 Lots more in there, but...

10 How are you doing? Do you need a break? Are
11 you good?

12 A Maybe in 15 minutes or so.

13 Q Okay. Okay.

14 So I know you were with the ATSDR for about
15 33 years, right?

16 A Right.

17 Q So -- almost. I'm going to show you a couple
18 of documents that the ATSDR says about its
19 mission/vision. So this is No. 11. It's "ATSDR
20 Background and Congressional Mandates." And No. 12 is
21 "ATSDR Mission, Vision, and Impact."

22 (Exhibit 11 marked for identification.)

23 (Exhibit 12 marked for identification.)

24 Q (By Ms. Greenwald) So under "ATSDR
25 Background and Congressional Mandate," it first

1 describes that Congress created the ATSDR in 1980 "to
2 implement the health-related sections of laws that
3 protect the public from hazardous waste and
4 environmental spills of hazardous substances."

5 Do you see that?

6 A Uh-huh. Yes.

7 Q Would you agree that was part of your
8 mission?

9 A Yes.

10 Q And then, that statute is called CERCLA?

11 A Yes.

12 Q "CERCLA, commonly known as the 'Superfund'
13 Act, provided the Congressional mandate to remove or
14 clean up abandoned and inactive hazardous waste sites
15 and to provide federal assistance in toxic emergencies.
16 As the lead agency within the Public Health Service for
17 implementing the health-related provisions of CERCLA,
18 ATSDR is charged under the Superfund Act to assess the
19 presence and nature of health hazards at Superfund
20 sites, to help prevent or reduce further exposure and
21 the illnesses that result from such exposures, and to
22 expand the knowledge base about health effects from
23 exposure to hazardous substances."

24 Do you agree with that?

25 A Yes.

1 Q And is that what you did for the 33 years you
2 worked there?

3 A Yes. In particular, the cooperative
4 agreement back in 19 -- I'm sorry, 1986, when we
5 received it in New Jersey, the health department, and I
6 worked on that cooperative agreement, is trying to meet
7 this mission --

8 Q I see.

9 A -- to look at -- because, as I said, they
10 hadn't looked at toxic waste sites and birth outcomes,
11 and that was a key area where they wanted to -- ATSDR
12 wanted to -- and CDC wanted to expand the knowledge
13 base on that.

14 Q So you were at the forefront of a lot of
15 these issues?

16 A Yes.

17 Q Then the last paragraph says, "With the
18 passage of the Superfund Amendments and Reauthorization
19 Act of 1986 (SARA), ATSDR received additional
20 responsibilities in environmental public health. This
21 act broadened ATSDR's responsibilities in the areas of
22 public health assessments, establishment and
23 maintenance of toxicologic databases, information
24 dissemination, and medical education."

25 Was that also part of what you did in your

1 years at ATSDR?

2 A Well, I did not work on public health
3 assessments directly. Sometimes I was asked to help
4 with some of the information going into them, but --
5 and I was -- again, with toxicology -- and we had a tox
6 profile program -- that, I helped on occasion. I
7 actually wish I had been able to help more because I
8 think that the epidemiologic information in the tox
9 profiles could have been enhanced if I had had more of
10 a role there. But I was very busy doing other work,
11 and I think that was part of the problem. But, yeah, I
12 mean, that's what we were supposed to do --

13 Q Okay.

14 A -- as an agency.

15 Q And then if you go to Exhibit 13 --

16 A Or 12?

17 Q Twelve. I'm sorry.

18 A It's okay.

19 Q It's 12. I had a different order in my
20 notes.

21 A Right.

22 Q The vision: "Most trusted agency protecting
23 American communities from environmental health threats
24 through application of state-of-the-art science."

25 Is that what you practiced during your years?

1 A I did, yes. Yeah.

2 Q And that was important to you to fulfill that
3 vision?

4 A Yes.

5 Q And the mission: "ATSDR protects communities
6 from harmful health effects related to exposure to
7 natural and man-made hazardous substances. We do this
8 by responding to environmental health emergencies;
9 investigating emerging environmental health threats;
10 conducting research on the health impacts of hazardous
11 waste sites; and building capabilities of and providing
12 actionable guidance to state and local health
13 partners."

14 Is that also part of the mission you feel you
15 fulfilled all those years?

16 A Yes. Yes.

17 Q And then there's a number of core values. I
18 won't read them, but they are Accountability,
19 Collaboration, Innovation, Equity, Integrity, and
20 Respect.

21 And if you could just read those to yourself,
22 if you don't know them, or you can read them out loud,
23 whatever. But do you agree that those are core values
24 that you followed and believed in for the 30 -- almost
25 33 years --

1 A Yes.

2 Q -- you worked --

3 A Yes.

4 Q Okay. And then "ATSDR Priorities," the
5 bottom of the list, it says, "In addition to the goals
6 and objectives outlined in the strategic plan,
7 NCEH/ATSDR aims to focus on four topical priority
8 areas: asthma, children's health, safe drinking water,
9 and innovative laboratory methods." Do you see that?

10 A Uh-huh. Yes.

11 Q And safe drinking water, we talked about
12 earlier, has been a big part of your work with the
13 ATSDR, right?

14 A Yes.

15 Q And that was central to the issues in
16 Camp Lejeune, right?

17 A Yes.

18 Q Okay. So you're sometimes referred to as an
19 advocate, right? You know that, right?

20 A Yes.

21 Q Okay. I applaud that term, and I want to go
22 over a little bit about what I believe you define as an
23 advocate, but I don't want to put words in your mouth.

24 So I'm going to show you an email that is one
25 of your self-appraisals. It appears to be from 2008,

1 which -- first is the email, just to give you a time
2 frame, and then the self-appraisal. So the email will
3 be Exhibit 13, and then the self-appraisal will be 14.

4 (Exhibit 13 marked for identification.)

5 (Exhibit 14 marked for identification.)

6 Q (By Ms. Greenwald) Here's the email that
7 gives it a time frame, and here's the self-appraisal.
8 Here's your self-appraisal, which is 14.

9 This appears to be a 2008 self-appraisal.
10 Does that seem right?

11 A I guess. I'm trying to figure out why this
12 was -- why I did it and what the point was.

13 Q I mean, I can help tell you why I think it's
14 the right one. In the bottom right-hand corner, see
15 it's got some funny numbers? Those are Bates numbers.
16 And it says 10891.

17 A Uh-huh.

18 Q And then the next one is 10892. So that
19 means they were produced to us together.

20 A Uh-huh.

21 Q And that's why I believe it's a 2008 --

22 A No, that wasn't the --

23 Q I'm sorry.

24 A I wasn't sure why I was asked to do this. I
25 guess that's what -- at the time. I'm trying to

1 remember. But anyway...

2 Q Yeah, I was wondering about that because
3 that's the only one we found. It doesn't mean there
4 aren't others, but I -- you don't remember doing this
5 on an annual basis?

6 A Yeah. Right. Okay. It's part of the
7 performance called PMAS, performance -- yeah. Every --
8 yeah, you're supposed to do a self-appraisal both at
9 the six-month period and at the end of the year to help
10 your supervisor decide what -- how you performed that
11 year. So that's -- so, yes, this happened every year
12 then. Okay. That's -- thanks for reminding me.

13 Q No, it's okay.

14 Under "Advocacy" on page -- the second page,
15 which ends in Bates 10893 --

16 A Yes.

17 Q -- can you read the -- since it's your words,
18 can you read the paragraph under "Efficacy," the first
19 paragraph?

20 A "Worked very closely with those affected by
21 exposures to contaminated drinking water at
22 Camp Lejeune, including daily phone conversations and
23 emails, CAP meetings, and informal meetings. Provided
24 informational materials on the risks of exposures to
25 the contaminants, as well as general materials on the

1 toxicology of the contaminants, epidemiologic study
2 designs, genetics (for example, gene-environment
3 interactions involving the contaminants), and water
4 modeling issues."

5 Q Okay. And then beyond that, you talk about a
6 couple of other pieces of work you were doing at that
7 time, right?

8 A Right.

9 Q Is that one of the ways in which you define
10 "advocacy"?

11 A Yeah. That's one of the ways, yeah.

12 Q Okay. And we talked earlier about your
13 interview in May 2018 by your alma mater called
14 Fords in Four. Do you remember that?

15 A Yes.

16 Q Okay. So we have that interview. This will
17 be Exhibit 15.

18 (Exhibit 15 marked for identification.)

19 THE WITNESS: So you also have a picture
20 of my daughter and I that's a part of that,
21 or no?

22 MS. GREENWALD: I don't.

23 (Discussion off the written record.)

24 Q (By Ms. Greenwald) Here's Exhibit 15.

25 A That went -- the picture went with this

1 thing.

2 Q Oh, okay. We don't have it with the picture.

3 I'm sorry.

4 Okay, this appears to be from May of 2018?

5 A I think so.

6 Q It says, "Fords in" -- under "Bove," it says,
7 "Frank Bove, 69, senior epidemiologist." Do you see
8 that in the upper left? Did I give you the right
9 document?

10 A You probably did, but --

11 Q I don't know -- let me just look at that and
12 find out.

13 A I'm trying to see where --

14 Q I have a different version.

15 A Oh, okay.

16 Q Okay, so mine looks a little different. So
17 yours is part of an email. Okay, never mind. Yours is
18 part of an email. I'm just going to go straight to
19 this -- well, you -- do you remember being interviewed
20 by your undergraduate alma mater about this?

21 A Yes.

22 Q Did you know about this Fords in Four before
23 you were --

24 A No.

25 Q -- contacted?

1 A No.

2 Q Okay.

3 A I've had very little contact with the school.

4 Q Do you know about this program, or is it just
5 out of the blue they called you?

6 A Out of the blue. I think they saw the Unsung
7 Hero Award, the Ozonoff Award, that prompted them.

8 Q Okay. So on page -- well, now I don't know
9 how to do this. Let's see. Question 3. Unless I have
10 a different version, Question 3.

11 A "What have you done since Haverford," is that
12 the --

13 Q It says, "What do you do on a day-to-day
14 basis as a senior epidemiologist? How would you
15 explain your work to others?" That should be
16 Question 3. Is it?

17 A It's --

18 Q All right, so I have a different version.

19 A You have a different version.

20 Q I apologize. I'm going to do this -- let
21 me -- I'm going to let you keep that, and I will do
22 this after our break, because my version is not the
23 same as yours. Sorry about that. So we'll go back to
24 that.

25 One more document, or do you want to take a

1 break?

2 A One more document.

3 Q Okay. So I'm going to show you what I'm
4 going to mark as, now, Exhibit 16. This one will be
5 the same.

6 (Exhibit 16 marked for identification.)

7 Q (By Ms. Greenwald) Do you recognize this
8 PowerPoint?

9 A Yes.

10 Q And did you prepare it?

11 A Yes.

12 Q Do you remember when? I don't see a date on
13 it.

14 A This looks similar to a TED Talk I did at
15 CDC, but I don't remember the date.

16 Q Did you do a TED Talk on Camp Lejeune?

17 A Camp Lejeune was part of it, but I was
18 talking more -- yeah, Camp Lejeune was definitely a
19 part of it, I used that as an example, but I think I
20 used other examples too. I talked about the issues
21 around how to interpret studies, in particular
22 statistical hypothesis testing and so on. So I talked
23 about that in here and then did so in the TEDMED.

24 So the TEDMED, I had to do without looking at
25 anything, but pretty much what I see in here is what I

1 presented.

2 Q Okay. Do you remember about when that was?

3 A Is it in my resume?

4 Q I didn't see it. So if it was there, I
5 missed it, so -- it's okay.

6 A Okay.

7 Q It doesn't matter.

8 A I can't remember exactly when.

9 Q Okay. If you go to the -- so these aren't
10 numbered. We're going to use the Bates numbers --

11 A This is before the pandemic, let's put it
12 that way.

13 Q Okay. All right.

14 A So it's probably sometime 2014 to 2017,
15 around that middle --

16 Q Okay. That's always helpful. That's what we
17 all use now, sadly, for our time frame.

18 A Yeah, yeah.

19 Q So I'm going to use the numbers on the bottom
20 right-hand corner because this isn't numbered.

21 A Okay.

22 Q So go to the second slide, which is Bates
23 121759.

24 A "Main Points."

25 Q "Main Points." The second one is, "To be

1 responsible to the needs and concerns of communities,
2 public health practice should adopt aspects of the
3 precautionary principle."

4 What is that? Can you describe what the
5 precautionary principle means to you?

6 A Yeah, well, I think it gives us -- there must
7 be a slide in here that actually -- yes.

8 Q There is?

9 A Sixty-three.

10 Q Okay. Let's jump to 63.

11 A And those are the, as I have there, central
12 tenets of the precautionary principle.

13 Q Uh-huh.

14 A I mean, heeding early warnings is, in
15 general, what the precautionary principle means. But
16 unpacking that, you have, "Take preventive action in
17 the face of uncertainty." So you don't wait until all
18 the bodies are in front of you. If you have some
19 information to act, you act. You may -- and there's
20 always uncertainty anyway. So that's the first one.

21 The key one -- a key one is shifting the
22 burden of proof from those who are upset or concerned
23 about a project to those who are advocating for a
24 project. For example, if someone wanted to put an
25 incinerator in your community, they have to show that

1 it's safe. You don't have to show that it's dangerous.

2 Q And why is that important?

3 A Because it's stacked the other way. It's
4 stacked the other way. In almost all situations, the
5 polluter or proposed -- whatever it is that has that
6 potential to pollute doesn't have to prove -- doesn't
7 have to prove that it's safe. The advocates, people of
8 the community, has to -- is given -- usually has the
9 burden of proof to -- and so that's trying to redress
10 that.

11 These are -- by the way, the precautionary
12 principle is something that was adopted in the
13 European Union. This is not, you know -- and so it's,
14 you know --

15 Q Right.

16 A It's not something --

17 Q It's a well-accepted principle?

18 A Yeah. It's not --

19 MR. BAIN: Objection.

20 THE WITNESS: Yeah, I mean, we haven't
21 accepted it -- the EPA has discussed it, and
22 I would say what the FDA does is sort of
23 precautionary, testing drugs before they're
24 put to use. So there are aspects of this
25 already, but not the whole -- not in this

1 country.

2 Q (By Ms. Greenwald) So can we stay on your
3 point about for a minute about shifting the burden,
4 sometimes referred to "as level the playing field."
5 But whatever word we use, is that not because the
6 proponent of an action that could cause harm or a
7 facility or an entity that's already caused harm has
8 most of the facts, and the community being impacted is
9 really without a lot of the facts?

10 A That's part of it.

11 MR. BAIN: Object to form.

12 You can answer. Go ahead.

13 THE WITNESS: That's part of it, lack of
14 information, because some of -- the company
15 may say it's proprietary, for example.

16 But there's also another issue, which
17 is, as I said, the burden of proof is on the
18 community oftentimes, in many instances.

19 So anyway -- so that's a part of it,
20 just to make -- "level the playing field" is
21 not a bad description of that. And then look
22 for alternatives too. And a key one for me
23 is increase public participation in
24 decision-making. That's the whole point of
25 having a CAP or some kind of entity, that the

1 community has input into your work.

2 Q (By Ms. Greenwald) So if we can go to the
3 slide -- a couple back -- that ends in 61. The bottom
4 bullet point in red says, "Advocate for public
5 health - an obligation to act," as one of the primary
6 duties of public health practitioners, right? And
7 would you consider that a primary duty for
8 epidemiologists --

9 A Yes.

10 Q -- as well?

11 A Yes. That's controversial. There are
12 epidemiologists who say that you should not do any of
13 this work or that your science should be pure and not
14 have any -- or not have direct policy implications, or
15 at least epidemiologists shouldn't be involved in that
16 effort.

17 So, I mean, I'm thinking of Kenneth Rothman,
18 for example, who has made that case over the years.
19 But I disagree with that. I think that epidemiologists
20 should play a role. We know something; we should play
21 a role in the policymaking. And in the case of
22 information we have on the dangers of a substance or
23 dangers of an exposure, we should act.

24 Q So I notice on the bottom of that slide, you
25 have some notes, and it says -- the last is, "They

1 think" -- "they," I assume that's people who don't
2 agree with you -- "They think you cannot be both a
3 scientist and an advocate/activist." Do you see that?

4 A Yes, I see that.

5 Q You believe those are compatible, don't you?

6 A Yes, absolutely.

7 Q Okay. So if you go to slide 66, did you use
8 the Woburn example as an example of why advocacy and
9 public participation advances science and knowledge?

10 A This is the Long Island breast cancer work,
11 where they had a map of where the breast cancers were,
12 also any information they had on environmental
13 exposures, and they put it together, the community put
14 it together. And that impacted the research that was
15 done, I guess, by NCI. I'm trying to remember who did
16 all the research. I think NCI was involved. I don't
17 remember if CDC was involved as well, doing -- looking
18 at Long Island breast cancer and doing a sequence of --
19 and, of course, the health department -- the New York
20 health department was involved.

21 It was -- a lot of the work was instigated by
22 the community's work itself. And that was true of
23 Woburn. The families, in particular one family whose
24 son had -- I think it was a son -- had leukemia, went
25 around and identified many of the cases.

1 That was also the case in Brick Township.
2 One family who had two children with autism identified
3 most of the cases in the community before health people
4 showed up, so that's -- that was an important -- that's
5 citizen science of a sort.

6 Q Okay.

7 A Yeah.

8 Q On page 69, you refer -- and also on page
9 70 -- I think they're similar -- a couple of slides
10 here talk about the difference between false positives
11 and false negatives and why -- sort of your views on
12 the importance -- or the -- let me ask this question
13 right.

14 What are your views on the significance of
15 false positives -- the lack of concern of false
16 positives versus the risk of false negatives?

17 A Well, what -- the way statistical testing is
18 set up is a problem because they use -- arbitrarily use
19 a .05 as an error rate for a false positive. And they
20 oftentimes, for no good reason, set .20 for a false
21 negative.

22 And so -- and my view is that they either
23 should be equal, so both should be .05 or .20, or there
24 should be some cost analysis done as to what is the
25 cost of a false positive and what is the cost of a

1 false negative, who bears those costs, right, and all
2 that should be put into -- if you're going to use this
3 method, that's -- you should do that. But no one does
4 that, and so that's part of the reason I am opposed to
5 using significance testing. There's a whole list of
6 reasons why I'm opposed, and a lot of -- most of those
7 reasons, if not all of them, are in American
8 Statistical Association articles that were written in
9 2016 and 2019 and where the American Statistical
10 Association, the head of it, in one paper in 2019 said
11 basically don't use it, simply said don't use
12 significance testing, and I agree with that.

13 Q Is there a shift right now in statistical
14 significance dialogue among scientists and
15 biostatisticians now on this issue?

16 A This issue is at least a hundred years old.
17 I, in fact, found something in the 1800s where there
18 was something like a dispute about this, so it goes way
19 back.

20 I know that Sander Greenland, who is a
21 well-known theoretician in epidemiology, and two
22 researchers put out a call for how many people -- how
23 many researchers agree with their position not to use
24 significance testing. And they initially got something
25 like 7- or 800 researchers saying, "We agree with you."

1 But I would say at this point, it's still
2 very much a controversy. The journalists and the
3 researchers still use it. And I've had to battle both
4 journalists and within the agency around this issue
5 over the years, trying to, you know, go through why
6 it's not a good approach, what the deficiencies are,
7 trying to promote a different approach, which, again,
8 some of these well-known theoreticians are pushing as
9 well.

10 Q I want to ask you about -- on page -- on
11 slide 74 -- not your cartoon, although I like your
12 cartoon a lot -- you write here, "Even when an
13 association between exposure and disease is observed,
14 the agency may claim that the finding does not
15 constitute 'definitive' or 'conclusive' proof of
16 causality." And this is the sentence I want to focus
17 on, "But this is misleading because no study, by
18 itself, can provide 'conclusive proof.'"

19 So that goes both ways, right? So no one
20 positive study, in the absence of everything else, and
21 no one negative study, in the absence of positive
22 information, can really answer a question on its own,
23 right?

24 A Right. Because most research, if not all
25 research, there is a background that promoted that

1 research in the first place. There's some information,
2 animal data, maybe -- in the case of vinyl chloride and
3 angiosarcoma of the liver, you know, reports that there
4 were too many cases, because you didn't expect any, in
5 a plant, so, you know, then you do a study.

6 So it's -- the study is built on previous
7 information and subsequent information. So in trying
8 to determine what the evidence -- how strong the
9 evidence is -- because in science, you hate to use the
10 term "proof," but how strong the evidence is, you have
11 to bring all that together.

12 So even for smoking and lung cancer, you
13 know, the epidemiologic studies done in the '50s were
14 helpful, you know, but there was also other
15 information. And together, with animal data and with
16 what they knew, they made a convincing case. They
17 still don't know the mechanism, though, and that would
18 make it even more convincing, and that's, you know --
19 so I'm just -- so that's what I mean here, is that a
20 lot of times -- and when I say "agency" here, I'm not
21 talking about ATSDR specifically.

22 Q Right.

23 A I actually think more about health
24 departments more often and cluster investigations where
25 they say, "Well, it's not statistically significant;

1 there's no problem here." And that's happened at
2 Woburn too. The way they -- they analyzed the wrong
3 outcome in particular on -- in that situation.

4 But again, you know, even if it's not
5 statistically significant or -- you know, you have
6 another information. Maybe workers who work with the
7 substance have had that disease or something like that.
8 So you need to bring in what they call our priors, our
9 background information, and inform the current study.

10 And that's what we did at Lejeune too. I
11 mean, the outcomes we focused on -- starting with the
12 birth defect study, we looked at outcomes that I found
13 in the New Jersey study and also the Woburn study and,
14 actually, the other New Jersey cancer study. So those
15 informed the Lejeune study there, the birth outcomes
16 and the birth defect cancer study.

17 The mortality study, occupational studies
18 really pushed that, because there was some evidence
19 already about trichloroethylene and kidney cancer, for
20 example.

21 Q And just one more thing and then break time,
22 because I know I've gone past the 15 minutes.

23 The second [sic] sentence there says,
24 "Nevertheless, a study can provide important evidence
25 for a causal association that, linked with evidence

1 from other research, can be scientifically convincing."

2 A Right. Yes.

3 Q So that's the flip side of what we just
4 talked about --

5 A Yes.

6 Q -- right?

7 A Yes.

8 Q Okay, you want to take a break?

9 A Sure.

10 THE VIDEOGRAPHER: Okay. The time is
11 11:02 a.m. Going off the video record.

12 (Recess taken.)

13 THE VIDEOGRAPHER: We are back on the
14 record. The time is 11:16 a.m.

15 Q (By Ms. Greenwald) Okay. Let's move to some
16 of the work you did at Camp Lejeune.

17 A Okay.

18 Q But before we do that, I want to ask you a
19 little bit about the peer-review process at the ATSDR
20 for published papers, basically any paper that you
21 worked on when you were there. I'll mark this as
22 Exhibit 17, in case you want this for reference. You
23 don't have to read it. I just wanted to
24 [indiscernible] need it for reference.

25 (Exhibit 17 marked for identification.)

1 Q (By Ms. Greenwald) So can you explain the
2 peer-review process to us, please?

3 A Well, it has -- we're required by the CERCLA
4 or SARA -- I can't remember which -- to peer-review all
5 our studies. And that would sometimes include
6 peer-reviewing the protocol, as well as the report on
7 the study or the article.

8 So we have -- so it goes through an
9 independent peer-review process. We usually pick
10 three -- either the science office at ATSDR asks us to
11 recommend people, or if we don't have any -- for some
12 reason, we don't have any ideas, they pick the people.
13 Their decision is the final decision, though. They may
14 disagree with your representations and pick three
15 people.

16 But usually, they pick at least one -- for
17 the epi studies, one epidemiology [sic], at least one
18 statistician, sometimes two epidemiologists and a
19 statistician. It varies. It depends on the study too.

20 So -- so, yeah, so every -- for example, the
21 cancer incidence study, we had not only a peer review,
22 but there was a meeting to discuss the protocol, to go
23 over it with a group of scientists in the room. And
24 then -- and then they had a chance to go back and then
25 provide additional comments to the initial protocol.

1 So that was -- so -- that and the -- I don't
2 think the mortality studies went through that rigorous
3 a situation, that was kind of rare, but we all -- all
4 the studies have to go through a peer-review process
5 set up by the Office of Science at ATSDR. And then
6 when it goes to a journal, it goes through another
7 peer-review process.

8 Q So I want to ask you about this -- where you
9 say sometimes the protocol itself goes through peer
10 review. So that's before you actually write the study,
11 that's when you come up with the protocol, and before
12 you even start doing the work on the study, you have
13 to -- you go through peer review on just how it's going
14 to be done?

15 A Yes.

16 Q And you said that was done for the cancer
17 incidence study?

18 A Yes, we had -- as I said, we had a meeting
19 of -- I don't know how many -- six, seven, eight
20 people, experts in epidemiology, in cancer registries.
21 We had at least one person who was a part of the
22 National Association of -- the North American
23 Association of Central Cancer Registries, NAACCR, and
24 also researchers who had done other cancer incidence
25 studies themselves.

1 So we had a room full of these people, and
2 went back and forth as to whether the protocol was the
3 proper approach. Some people thought there was another
4 approach that might be useful. We had that debate.
5 But the protocol pretty much was accepted pretty much
6 the way it was. So that reassured us and it was --
7 that was important for the -- they felt that way.

8 The mortality studies were more -- were
9 simpler. They really were -- you know, mortality
10 studies are standard pretty much in the occupational
11 field, occupational health field. So I don't think
12 that was -- I don't remember the protocol there, going
13 through the, kind of, committee meeting like that. It
14 may have been peer-reviewed, I can't remember, the
15 earlier mortality study. But the study itself was -- I
16 mean, the report was peer-reviewed, the --

17 Q Right.

18 A Yeah. Whether the protocol was, I can't
19 remember. But the protocol for the cancer incidence,
20 and I think also for the current mortality study, was
21 also evaluated. So -- and for the assessment of the
22 evidence, there was a peer review early on, and that's
23 a whole -- there's a whole story behind that one. And
24 then --

25 Q We'll get to it.

1 A -- there was a peer review once the report --
2 a draft was written. So there was two peer reviews
3 there. And those were the only two peer reviews for
4 that because that was not submitted to a journal.

5 Q Okay. So let me ask you a couple of
6 follow-up questions to your answer.

7 So I think you mentioned -- and if I got it
8 down wrong, please correct me. I think you said that
9 the protocol for mortality studies are more standard in
10 the occupational field than the cancer incidence study
11 would have been. Did I get that right?

12 A Yeah.

13 Q So what does that mean, "more standard"?

14 A Well, first of all, the data is easier to
15 obtain. The National Death Index is available.
16 There's no such thing as a national cancer incidence
17 database where you have personal identifying
18 information linked to it.

19 So that's a major difference right there.
20 There are very few studies done on cancer incidence
21 because they're difficult to do, and -- whereas
22 mortality studies, you have -- if you can identify the
23 cohort, you have some identifier, like social security
24 number would be important to have, then you can match
25 it to the National Death Index, get causes of death,

1 specific causes of death, and do a study.

2 I mean, it's not that simple, but -- but at
3 least there's that database. Otherwise, as I said, for
4 cancer incidence, you either have to go to a cancer
5 registry or a group of cancer registries like the --
6 NIOSH did a study of firefighters, and I think they
7 used 10 cancer registries that were around the
8 firefighters that -- the cities, the three cities, I
9 think, they have.

10 So there are cancer incidence studies, but
11 they're difficult to conduct for that reason.

12 Q I see.

13 A But there's no national registry.

14 Q And so -- so talking about mortality studies,
15 the death --

16 A National Death Index.

17 Q National Death Index. That just refers to
18 the cause of death on a death certificate, right?

19 A Right.

20 Q Okay. So if someone -- I know you -- I think
21 it's in one of your papers or somewhere, I saw a
22 comment that if someone had cancer, but they were
23 killed in a car accident, the cause of death would be
24 the car accident, not cancer?

25 A It would be missed, yeah.

1 Q Okay.

2 A That's a limitation of mortality studies, is
3 that you'd rather have -- for cancer or for Parkinson's
4 or any of the diseases, you'd rather have incidence
5 data than mortality data. But all else fails, you have
6 mortality data.

7 Q Okay. And so -- so you mentioned that the
8 cancer incidence study went through a peer review for
9 the protocol.

10 A Yes.

11 Q Was that the kind of peer review that you
12 talked about where you recommended a few people, and
13 then other people recommended people, and those people
14 were brought together and looked at the protocol?

15 A I think I was the one who recommended all
16 those people because I knew who had done studies on
17 cancer incidence --

18 Q Okay.

19 A -- and who was -- who worked for a registry
20 that was -- you know, we asked a couple of registry
21 people on one, you know, so I -- if I recall, I did --
22 I picked those people for the most part. And I think
23 that's because the Office of Science deferred to me
24 because I was the internal expert on this.

25 Q Uh-huh.

1 A And that's, you know -- but as I said, they
2 often asked us for recommendations. And most of the
3 time, I would say, they used our recommendations, maybe
4 add one person or -- oftentimes, some of the people we
5 recommend can't do it.

6 Q Okay.

7 A People are busy, so --

8 Q And when you -- I'm sorry. I didn't mean to
9 cut you off

10 A So they pick somebody if we're having trouble
11 getting people. And that's happened on occasion.

12 Q Okay. When you send a paper in to a journal
13 for peer review, those are -- are those blind, or do
14 you also recommend --

15 A No, no, no. The journal -- the journal picks
16 them.

17 Q Right.

18 A I noticed Environmental Health Perspectives
19 said, "Do you have some people in mind?" So they
20 actually do that, but that may be -- that's new for me.
21 I don't recall that in any of the other journals, so --
22 I was never asked. That was the first time I was asked
23 by a journal. Whether they actually picked those
24 people, I have no idea.

25 Some journals will let you know who the

1 reviewers are, and some won't. It's up to, actually,
2 sometimes the interviewer, does the reviewer want you
3 to know.

4 Q Okay. So when you're talking about doing a
5 study, like a mortality study or a cancer incidence
6 study, which I understand is a more complex, robust
7 type of study based on --

8 (Interruption in the proceedings.)

9 Q (By Ms. Greenwald) Apologies, Dr. Bove, for
10 that little interlude.

11 Are there, sort of, key components that one
12 would look for in a high-quality study of either
13 mortality and/or cancer incidence that would be, like,
14 common to these type of studies, or do you have to look
15 at them separately? Is there a commonality between
16 them as far as what would be a high-quality study? And
17 maybe I should go over some of the ideas I have, and
18 maybe that would be easier for you.

19 A Well, I mean, a high-quality study would have
20 a good exposure assessment. And also, good outcome
21 data that's verified, that would be good.

22 The problem with a survey, for example, is
23 oftentimes we don't verify the outcomes that are
24 reported to us. But if you have -- but the
25 occupational studies, some use a job exposure matrix,

1 depending on the study. Some use plant-specific, which
2 is better than a generic job exposure matrix, which
3 would cover various occupations and various plants that
4 use the chemicals. That's a little less accurate to
5 some extent.

6 So the better the exposure assessment, the
7 better the study, in particular if you have -- if you
8 take body sample -- fluid samples or, you know, you
9 take some kind of sampling that enhances the exposure
10 assessment. So that's one side. The other side is to
11 have verified outcome data --

12 Q Okay.

13 A -- cancer registry data, National Death
14 Index, or some medical records to do that.

15 So those are -- now, some people say, well,
16 if you don't look at smoking, you know, you don't ask
17 for smoking, that's a detriment to your study, for
18 example, if you're doing a cancer or any
19 smoking-related diseases.

20 However, you can -- you can deal with that
21 problem to a great extent by determining whether other
22 diseases that are smoking-related, but not related to
23 the exposure you're interested in, are elevated or not.

24 If you don't see -- for example, in the work
25 we did in the cancer incidence study and the mortality

1 study, chronic obstructive pulmonary disease, it's not
2 related to any of these chemicals in the drinking
3 water, at least as far as we know, but it is
4 smoking-related.

5 So if you don't see an increase in COPD in
6 one group versus another, there probably isn't much of
7 a smoking difference. Between the two, there's not
8 much of a smoking difference. There's really no
9 problem with confounding or very minimal confounding.

10 So even if you don't get smoking information,
11 you can tease out how bad the bias might be and in what
12 direction.

13 So I don't -- so to me, a good --
14 high-quality study, sure, if they get smoking
15 information and it's good information, that's fine.
16 But a high-quality study doesn't necessarily have to
17 have smoking information.

18 Q Okay.

19 A The main thing is to have a good assessment,
20 exposure assessment, good outcome assessment, and
21 interpret it properly -- that's another problem -- and
22 minimize as many of the biases as you can. For
23 occupational studies, a healthy worker; for veteran
24 studies, a healthy veteran effect. You have to keep
25 those biases in mind. Selection bias could be a

1 problem because you've lost people to follow-up, for
2 example.

3 So, you know, if you minimize these biases,
4 that would be a high-quality study.

5 And high-quality studies are -- you know,
6 when NCI does a study or NIOSH, they're usually high
7 quality.

8 Q Uh-huh.

9 A And IARC, when they do a study, usually high
10 quality.

11 Q So can I go through some of the factors
12 that -- I'm going to ask you, for example, if these are
13 factors or components that you would say are present in
14 the studies that you did for Camp Lejeune --

15 A Uh-huh.

16 Q -- that you have in front of you right there.

17 A Uh-huh.

18 Q So the cohort size, is that something you
19 would consider the larger the cohort size, the stronger
20 the study?

21 A Yes, as long as it doesn't impact your
22 exposure assessment. If you --

23 Q What do you mean by that?

24 A In other words, if you -- if you include more
25 people, oftentimes -- sometimes, it may weaken your

1 exposure assessment, because you're putting people in
2 there you're not sure of their exposures and stuff.

3 Q Okay.

4 A So as long as it doesn't affect -- it doesn't
5 impact the exposure assessment, yes, the larger the
6 cohort, the better, especially if you're looking at a
7 rare disease, like cancers.

8 Q Okay. So a large cohort provided that cohort
9 are exposed people?

10 A That you've defined the exposure properly.

11 Q Okay.

12 A So they could have various exposures, as long
13 as you define them properly --

14 Q Okay.

15 A -- assess them properly.

16 Q And would you also agree that extensive or
17 regular follow-up is something also important if you're
18 doing a longer-term study?

19 A If you can do follow-ups, yeah. Oftentimes,
20 that's -- studies haven't been followed up. But in the
21 occupational field, some have. There have been
22 dry-cleaning studies where the NCI has followed these
23 people over time and keeps reporting new findings from
24 it.

25 Q And a term that I've seen in some of the

1 materials is "AIC" -- I don't know how to say this --
2 Akaike Information Criteria. It's A-K-A-I-K-E.

3 A Yeah.

4 Q I don't know how to say that word. How -- do
5 you know how to say it?

6 A No.

7 Q Okay.

8 A It's a person's name.

9 Q We'll just call it AIC. It's a modeling to
10 define study ranges; is that right?

11 A Yeah, I see it as one measure of the model
12 fit, and it's useful, I mean, if you're looking at
13 various different models. For example, if you have
14 four variables in one model -- exposure, maybe smoking,
15 alcohol, and, I don't know, some other thing -- and
16 this study has three, you can compare them with this
17 AIC if you take -- if you have two models with -- both
18 having four variables in it, but different ones, you
19 can, again, look at AIC.

20 If you're -- I used AIC quite a bit to look
21 at the splines, the -- how to explain this -- the
22 dose-response curves that aren't -- that are -- that
23 take into account that the curve may change its shape,
24 and you can look at AIC to see which -- where to put
25 the knots where the changes occur.

1 So there's various things you can do with
2 AIC. But mostly, in general, it's some kind of
3 goodness-of-fit approach. There are other statistics
4 that also look at goodness-of-fit, but AIC seems to be
5 one that a lot of people use.

6 Q So you're looking for a high number for AIC,
7 is that -- or just --

8 A I can't remember now.

9 Q Okay.

10 A This, I can't remember.

11 Q Okay. That's okay.

12 A I haven't used it in a while.

13 Q Okay. And if a study has a bad AIC, whatever
14 that -- whether it's high or low --

15 A Yeah.

16 Q -- what would that mean?

17 A Just means that the fit is not as good, so
18 you may want to go with the model that has the better
19 AIC. And, again, I can't remember if it's higher or
20 lower.

21 Q That's okay.

22 A That's what happens in retirement.

23 Q What about SMR, Standardized Mortality Ratio?

24 A Yeah, SMR could also stand for Standardized
25 Morbidity Ratio. But, yeah, usually -- because it's

1 hard to do incidence studies, it's usually death
2 studies, it's a standardized mortality ratio. And
3 that's the observed over the expected, and you -- the
4 observed number of cases of the particular cause of
5 death you're interested in. The expected number comes
6 from the age distribution and maybe sex and race
7 distribution of your population times the -- some kind
8 of standard rates, usually taken from, like, CDC WONDER
9 or cancer -- U.S. cancer rates or whatever. And NDI
10 actually has their own death rates that you can use
11 automatically. So if you put the data in properly, you
12 get -- it kicks out an SMR for you for each cause of
13 death.

14 Q Okay.

15 A So that's why there's a lot of -- mortality
16 studies, it's very useful, the National Death Index,
17 and makes it easier for you to do these studies.

18 Q Okay. What about the Cox Proportionate [sic]
19 Hazard modeling? And I think -- if I recall, one of
20 your studies used Cox and the other one Poisson,
21 POISSON.

22 A Yeah. They're actually similar.

23 Q Okay.

24 A The Cox model looks at each age -- or age is
25 the time variable that we do. Other researchers use

1 time to tumor or some other time variable, but because
2 cancer and age are so highly related, it's useful to
3 use age as your time variable.

4 So as people age and you have an event, like
5 a cancer, that you're interested in, the Cox model
6 takes that into account. So the Cox -- whereas the
7 Poisson, instead of fine -- more fine ages, the Cox
8 model -- the Poisson model will use age groupings.

9 So if you want to think about it, Cox model
10 is more individual level, Poisson is more aggregate --
11 is aggregate level, not more aggregate level.

12 Q Okay.

13 A So if you don't have -- if you have broad
14 information on people, but you don't have specific
15 information on when they died or what age they died,
16 but you have sort of a -- if you can group -- if you
17 can use age -- broad age groupings, five-year age
18 groupings, ten-year age groupings, and you have race,
19 sex, and so on, you can do a Poisson model, and you get
20 roughly -- you can get roughly the same answer.

21 The value of a Cox model is it takes into
22 account when the cancer -- disease occurred, as well as
23 the difference -- the magnitude of the difference
24 between the two, so -- whereas if you do logistic
25 regression, for example, it figures out how many deaths

1 occur at the end of follow-up and compares that with --
2 you know, if you have an exposed group and unexposed
3 group, which one has a higher odds, but it doesn't take
4 into account when those diseases occur, what ages, were
5 the ages among younger people. The Cox model takes
6 that into account. So it's more suitable, a better
7 model to use, if you can use it, if you have that
8 individual level of data.

9 Q Understood. Okay. And then what about
10 QBA --

11 A Quantitative bias analysis.

12 Q -- quantitative bias analysis methods --

13 A Yeah.

14 Q -- what about that? How does that play
15 into --

16 A Okay.

17 Q -- a high-quality study?

18 A Well, most studies don't use quantitative
19 bias analysis. That's -- there was a textbook that was
20 produced a couple of years -- well, several years ago
21 now that there's been a second edition -- trying to
22 promote the use of quantitative bias analysis to look
23 at confounding.

24 People concerned about confounding all the
25 time, well, just how bad is it and what direction is

1 it. It's not enough to say, oh, they didn't take into
2 account smoking; there must be confounding. Oh, yeah,
3 well, how much, which direction? That's what
4 quantitative bias analysis is getting at. If you have
5 a selection bias problem, how much, you know, which
6 direction again. And same with exposure
7 misclassification.

8 For those biases -- selection, confounding,
9 exposure misclassification -- you can do these methods
10 that we do in these studies. But there are other
11 methods you can use. You can -- again, I mentioned --
12 it's called negative control diseases. You can look at
13 COPD, and the chemicals that you're interested in don't
14 cause it. So if there's a difference in COPD in the
15 exposed versus unexposed, it must be because there's a
16 smoking difference. But if you don't see a difference
17 in COPD, then they're probably similar in smoking.

18 So you can do a quantitative bias analysis
19 just by doing that. I would consider that part -- and
20 we use a -- we use both. We use negative control
21 diseases and the formal quantitative bias analysis in
22 the cancer incidence and mortality study.

23 Q In both of them?

24 A In both of them.

25 Q Okay. Now, is that true for all three

1 mortality studies?

2 A No. The other ones, we did more of what I --
3 the other approach. We didn't use quantitative bias
4 analysis. We used negative controls. I think we even
5 call it that in that paper. I can't remember. But
6 yeah, so instead of actually coming up with a -- if you
7 look at the cancer incidence study, for example, there
8 are these tables where -- different possibilities of
9 the bias and what the impact would be. That's a
10 quantitative bias. We didn't do that for the earlier
11 mortality studies.

12 Q These are factors that you would take into
13 account anytime you're going to do a study, and you
14 decide what to apply in the various studies given the
15 facts and the materials that -- the information that
16 you have?

17 A Can you repeat that again?

18 Q Sure.

19 A I missed the early part of that --

20 Q So we went through a lot of different
21 factors.

22 A Yeah.

23 Q And I realize in some of the factors, just,
24 like you said, for example, the QBA, you applied in the
25 cancer incidence study and the 2024 mortality study,

1 but not in the 2014 studies?

2 A Right.

3 Q So as an epidemiologist, when you're
4 designing a study, do you consider these various
5 factors and decide what you can use based on the
6 information you have? Like, how does one decide which
7 of these components you're going to apply to your data
8 and your analysis?

9 A I mean, it depends on if you're -- I mean, I
10 anticipate that people will be concerned about smoking
11 and alcohol consumption and maybe even lifestyle
12 differences between Camp Lejeune and Camp Pendleton,
13 for example. And so that pushes me to try to address
14 those by looking at how big the bias might be.

15 We didn't collect that information. We
16 didn't collect information on what they ate, what
17 they -- drinking. Even if you collected that
18 information now, how good would it be back then? So to
19 address those issues, you try to use negative control
20 diseases, for example, and quantitative bias analysis
21 is also useful.

22 As I said, quantitative bias analysis is
23 slowly getting used, but I rarely see it yet. I think
24 that it will continue because they're teaching it. And
25 it's easy to do now because they have spreadsheets that

1 make it easy for you to use it. But, you know, it's
2 new, so to speak, relatively speaking. So that's the
3 reason I did those -- I would do that, is because I'm
4 concerned that people might -- attack the study for
5 those reasons. I want to head that off by saying this
6 is how bad it might be or not bad at all.

7 Q So you mean, like, the impact it would have
8 on the --

9 A Yeah, I mean, confounding -- most people
10 think of confounding -- that it means that you have an
11 elevated risk ratio, for example, but it's really not
12 that. It's elevated because of smoking or something.

13 So that -- you know, so the direction of the
14 biases in that direction to inflate something, that's
15 what most people are afraid of. But actually, it can
16 go in the other direction. It really depends on the
17 prevalence of that confounder, smoking, let's say, in
18 the groups you're comparing.

19 So if there's no difference, there's no
20 confounding. If one group has -- you know, if the
21 exposed people smoke less, then you're underestimating,
22 you know. And if they smoke more, you're
23 overestimating, for example.

24 Q Right. So if they smoke less, it --

25 A Then --

1 Q Bias is to the null?

2 A Bias is towards the null. So bias towards
3 the null happens -- it could happen in confounding, but
4 most people think of it as the other direction.

5 Again, oftentimes because the paradigm is
6 smoking, and comparing a workforce with the general
7 community or something of that sort where that -- there
8 would be differences. But if you actually compare
9 workers in a plant, usually there's no -- hardly any
10 differences. They all smoke. Or in the case of
11 Marines, most of -- many of them smoked back then, and
12 so there are really no differences. You don't see
13 any.

14 Q When you say "differences," you're thinking
15 of Camp Lejeune versus Camp Pendleton?

16 A Yeah, I mean, in general, Marines back then,
17 at least half of them, maybe more, smoked a lot. So,
18 you know, smoking is a question, and so it's important
19 to indicate just how bad that might be, how bad --
20 affecting which direction it would go. And that's -- I
21 think that's important. A good study will -- certainly
22 in the future, good studies will use these methods.
23 I'm sure they will. But anyway -- so I don't know if
24 that answers the question.

25 Q So for purposes of some of your comparisons

1 between Camp Lejeune and Camp Pendleton, I know you do
2 address smoking and alcohol consumption in those; but
3 essentially am I correct that because these are similar
4 demographics of young men, predominantly, entering, in
5 their late teens, early 20s, into the military, you
6 didn't see that as a big factor -- as a difference
7 between those two populations; is that fair?

8 MR. BAIN: Object to the form.

9 THE WITNESS: Yeah, I didn't think that
10 we would see a big difference, but I wanted
11 to show it.

12 MS. GREENWALD: Right.

13 Q (By Ms. Greenwald) Okay, let's go to the
14 2017 assessment, the big one --

15 A The big one.

16 Q -- which I think is Exhibit -- let me just
17 look -- Exhibit 6. No, not Exhibit 6.

18 A There it is. Five.

19 Q Exhibit 5. Okay.

20 Are you one of the principal authors of the
21 2017 assessment?

22 A I am the author.

23 Q You are the sole author?

24 A (Nods head affirmatively.)

25 Q Okay. Can you just sort of give, like, an

1 overview of what you were -- why you did this study and
2 what you were trying to accomplish? And then I'm going
3 to ask you some questions specifically.

4 A Well, first of all, it's not a study. It's
5 an assessment.

6 Q Assessment. I'm so sorry.

7 A It's not a meta-analysis.

8 Q Right. Correct.

9 A It's not -- it's sort of, kind of, a
10 systematic review, but the whole -- but we
11 don't normally -- ATSDR doesn't normally do this.

12 What happened was the VA decided, with a lot
13 of pressure being put on them, to list kidney cancer,
14 acute myeloid leukemia, and angiosarcoma of the liver
15 as the three presumptive diseases that they wanted to
16 do. And that was not acceptable to the CAP or to the
17 three senators in this room that we were in
18 Washington -- in Congress. The three senators were the
19 head of the -- I forget his name. But anyway, there
20 were three senators, the two senators from
21 North Carolina and the senator from Georgia, who I'm
22 blanking on, who's died, who has since passed.

23 And if you looked at -- kidney cancer, for
24 sure, should be on a presumption list, there's no
25 question about that, when dealing with

1 trichloroethylene.

2 Acute myeloid leukemia makes a lot of sense
3 if we're talking about benzene, for sure.

4 Acute -- angiosarcoma of the liver, you would
5 never see at Camp Lejeune. That's an -- you have to
6 have a heavy exposure to vinyl chloride, which you
7 would only get in certain manufacturing. It's a rare
8 disease anyway; and, in fact, I think there was, like,
9 three at this one plant that started the whole -- that
10 was a cluster. So you rarely see it, even in a vinyl
11 chloride plant, but you shouldn't see it at all.

12 So putting that on the -- really, there
13 were -- so there were really only two diseases, really,
14 that made any sense to be on that list that the VA was
15 proposing.

16 And so they were -- the senators pushed them
17 hard. The VA secretary looked to me and Dr. Breysse,
18 who was the head of the agency at that point, and said,
19 "Can you help us?"

20 And we said, "Yes."

21 "Can you give us something in six weeks?"

22 "Yeah, we'll do it."

23 So I dropped everything and -- most of the
24 tables you see in here were done within that six-week
25 period.

1 During that period, I had enough material
2 together so that it was peer-reviewed by two people to
3 give their advice. One person liked it, one person
4 didn't like it, but that -- so -- and I took their
5 comments into account. And we briefed the VA
6 researchers/scientists.

7 So this was, I think, in -- July 2015 was the
8 meeting with the senators, somewhere around there. The
9 briefing was six weeks later. It was, roughly, in the
10 middle of September 2015.

11 And for the most part, they agreed with what
12 my -- with what my assessment was. There were some
13 disagreements. Bladder cancer was a disagreement.
14 Scleroderma was a disagreement. Chronic kidney disease
15 was a disagreement. Cardiac defects at the end was put
16 in there because a CAP member wanted me to address it,
17 but it was really not something the VA was concerned
18 about. So --

19 Q I'm sorry. Go ahead.

20 A So I started to write it up. But we also had
21 this debate with the VA around bladder cancer in
22 particular and tetrachloroethylene. And there was a --
23 IARC had done -- the International --

24 Q International Agency for Research on Cancer.

25 A I always have problems with it. I just call

1 it IARC all the time.

2 Again, what they do is just a systematic
3 review at that point, although they did a quickie
4 meta-analysis. I was there when they were discussing
5 the TCE and PCE.

6 For TCE, the kidney cancer was -- everyone
7 agreed. Non-Hodgkin's lymphoma, there was a debate.
8 Liver cancer was -- it was not as well-supported.
9 Non-Hodgkin's lymphoma, there was a big debate.

10 Q Can I stop you for a minute there?

11 A Yeah.

12 Q The debate, was that with the VA, or was that
13 the debate that you had with IARC?

14 A No, no. I'm sorry. In IARC, yeah, yeah,
15 yeah.

16 Q I just want to make sure this is clear.

17 A Right.

18 Q So the debates you're talking about right --
19 I didn't mean to cut you off.

20 A Right now, this has to do with IARC and TCE
21 and PCE.

22 Q Understood.

23 A For PCE, bladder cancer, there was some
24 evidence. There was a debate about that, how strong
25 the evidence was, and then -- and to try to deal with

1 the issue, IARC commissioned the meta-analysis looking
2 at bladder cancer, in particular with dry-cleaning
3 workers, but also workers who use PCE in the
4 manufacturing process.

5 And their meta-analysis is included in this
6 report, this assessment. I thought it was strong
7 enough to conclude that bladder cancer was sufficient
8 evidence. I think it was a strong meta-analysis done
9 by IARC. And I'm pretty sure they would have said so
10 too, but they didn't -- they haven't -- I don't know if
11 they've revisited PCE since then.

12 But anyway, so I pushed that with the VA. I
13 also was able to produce some mechanistic ideas, how
14 PCE might cause bladder cancer. And that's all in
15 here.

16 So while I was writing the other parts of the
17 assessment, I was researching bladder cancer and PCE
18 and trying to make a case so the VA would change their
19 position, and they did change their position. So
20 that's why bladder cancer is on the presumption list
21 and why it's -- in here, it's called sufficient
22 evidence. I thought there was strong evidence for
23 chronic kidney disease and scleroderma. My
24 understanding was OMB decided there wasn't for
25 scleroderma, without giving any reasons, to me anyway.

1 Chronic kidney disease, I think the VA felt
2 that that would be a huge grab bag of people having all
3 kinds of kidney problems, similar to the problem
4 they're having with neurobehavioral effects, which is
5 also a grab bag and, you know, can include almost
6 anything. So I think that's why they objected to that.
7 I think the evidence is strong there, but we didn't win
8 that one, that battle.

9 Q Okay. So let me unpack some of this, okay?

10 A Sure.

11 Q So when you were talking about that -- we
12 have a couple of "disagreements" here, and I want to
13 make sure -- you were referring to "disagreements," not
14 you and I.

15 A Oh, okay.

16 Q I want to make sure that I know which
17 disagreements you're referring to.

18 When you were talking about bladder,
19 scleroderma, and chronic kidney disease, that was
20 disagreements --

21 A With the VA.

22 Q -- with the VA and the assessment -- or, I'm
23 sorry, the VA believing that those diseases should
24 be --

25 A Remember --

1 Q -- [indiscernible] diseases?

2 A -- initially it was a briefing --

3 Q Right.

4 A -- with these tables, for the most part.

5 Q Okay.

6 A I did add things to the tables when we
7 continued the literature review. But both of these
8 tables are pretty similar to what I presented to them
9 in the long briefing that we would do.

10 Q So this -- so the discussion, disagreement,
11 whatever we want to call it, that you were having with
12 the VA was based on the tables but not the text?

13 A Well, it was based on the text, too, because
14 I had written some of the text.

15 Q Okay.

16 A Yeah. The text, I kept working on, and then
17 reacted to peer-reviewers of the -- a draft of this.

18 Q Okay.

19 A So, again, the task was to help the VA to
20 develop a presumption list. So the key thing was the
21 initial briefing that I gave them in September 2015,
22 and then the discussions back and forth around bladder
23 cancer.

24 Once that was decided, and then they decided
25 not to include chronic kidney disease and scleroderma,

1 they said OMB decided for some reason not to include,
2 that the list was set. And so I just, you know, did
3 some more writing, but most of the writing had already
4 been done, and then we peer-reviewed it, made some
5 changes, and so on.

6 So a lot of the introduction, too, had been
7 written, and that was peer-reviewed initially by the
8 two people. And I think there were just two. They
9 also looked at some of the tables and some of my
10 assessment, I'm pretty sure. By that point, they would
11 have seen that table you see on page --

12 Q Which table are you referring?

13 A Let me see if I can find it in here. Pages
14 13, I think it is --

15 Q Okay.

16 A The table that has the overall summary. I
17 think they probably saw that too, the first group of
18 peer-reviewers.

19 Q So you're talking about pages 13 --

20 A Yeah.

21 Q -- and 14?

22 A Uh-huh.

23 Q Okay. And so it was this -- this table that
24 was available during your discussions with the VA?

25 A Yeah, I think so.

1 Q Okay.

2 A Yeah, because I had to have some summary
3 thing. I probably had that already done for them. I
4 also had tables. It was done in a Zoom call, but I
5 think there was someone in the room, and they had --
6 they were able to get the hard copies, I think. I'm
7 trying to remember. It was a long briefing.

8 Q Okay. So do you know who the two
9 peer-reviewers were? Do you remember?

10 A David Kriebel, who's at Lowell. He's done a
11 lot of occupational epi studies. And I'm blanking on
12 the other one. He's at Emory. Kyle Steenland.

13 Q So were the peer-reviewers reviewing this for
14 methodology, or were they reviewing it for outcomes?
15 Both? Neither?

16 A Both. I think Kyle Steenland focused a lot
17 on the outcomes. His comments were, "Well, this
18 doesn't jibe with what IARC says." But IARC says some
19 things, EPA says some things, the National Toxicology
20 Program says some things. Trying to bring them all
21 together, that was the point of this. So I had a
22 problem with what -- that advice from him.

23 But the methodology, he didn't have any
24 problem with. David Kriebel had some ideas on that, in
25 particular trying to decide how long you had to be

1 exposed before you -- you know, it would be sufficient
2 to see something. And I was trying to figure that out,
3 looking at all the studies. And his comment was,
4 "Don't try. You won't be able to find it." And I
5 think he was right.

6 It is impossible to know how -- if it's a
7 birth defect, you know, exposures during a particular
8 point in time, you don't know how much, but probably a
9 very low dose could cause something if you hit it at
10 the right moment. But for cancers, how long you have
11 to be exposed really depends on how high the exposure
12 was you got in the first place. But we don't have any
13 information.

14 I know that the World Trade Center, they've
15 come up with some minimum exposures. But I feel, in
16 looking at the literature, it would be hard -- I
17 wouldn't feel comfortable doing that. And so that was
18 one of the suggestions: Don't do it.

19 I'm trying to think of something that was --

20 Q We will get to that in a minute. I guess
21 I --

22 A The -- no one had a problem with the
23 classification scheme, at least in the initial peer
24 review. So later ones, I think they -- they wanted to
25 know why I put this together. I thought I had made

1 that case pretty clear, but I probably added additional
2 text to strengthen that.

3 Q So when you refer to "classification scheme,"
4 are you referring to pages 6 and 7? Is that what you
5 mean?

6 A Yes.

7 Q Or are you also including page 5,
8 "Classification of Evidence"? I want to make sure --

9 A Six has -- 6 and 7 --

10 Q Right --

11 A What's on page 5?

12 Q -- that's the scheme. Five is where you talk
13 about the evidence.

14 A Yeah, here's the scheme. Sufficient
15 evidence, equipoise and above --

16 Q Right. Okay.

17 A -- that was the one I chose. IOM used
18 another one for Agent Orange. They used -- I think
19 they used the same one for Gulf War. But they had
20 recommended this for VA work. And they also kept
21 changing the definition, I thought, when I looked
22 through the Gulf War reports.

23 So I thought the best thing to do was to do
24 what the VA should do, which is give the benefit of the
25 doubt to the --

1 Q Uh-huh.

2 A And so equipoise made sense.

3 Q I know you mentioned IARC earlier. The
4 methodology you -- not necessarily the classification
5 exactly, but the methodology you used to determine
6 whether something is equipoise or above or sufficient
7 or below equipoise, isn't that really similar to the
8 methodology used by IARC?

9 A Well, IARC takes -- you know, has separate
10 analysis of the animal data, the tox information,
11 mechanistic information, and the epi, you know, and
12 they make -- they classify both, and then they bring it
13 all together and it's an overall classification, so --
14 so that's different.

15 I mean, these are all -- they're similar.
16 NTP has one. EPA sort of has one. And, you know, it's
17 roughly -- they're roughly similar. It's all a
18 judgment call, you know, what a high-quality study, do
19 you agree with that meta-analysis, do you agree with
20 that systematic review, do you have any -- you know, it
21 is a judgment call where you put it. And I wanted to
22 make that clear in here too --

23 Q Right.

24 A -- that it is a judgment call.

25 Q And I want to make sure I understand what --

1 how you -- what evidence you used to reach your
2 conclusions here. Again, I'm focusing on the five
3 diseases in Track 1.

4 If I understand right, you used data, if it
5 was available, on the chemicals and those outcomes from
6 EPA?

7 A Uh-huh.

8 Q National Toxicology Program?

9 A Yes.

10 Q IARC?

11 A Yes.

12 Q And then you did your own PubMed search?

13 A Yes.

14 Q But only for sure epidemiology; is that
15 right?

16 A Yes.

17 Q And you only considered animal data and/or
18 mechanistic data if it was included in IARC or one of
19 the epidemiological studies that you looked at; is that
20 right?

21 A Yes.

22 Q Okay.

23 A Because -- right, because you didn't have
24 time. I mean, I had -- you know, it was really done
25 quickly to help the VA. That was the whole point of

1 it. We wouldn't have done it otherwise, except we were
2 requested.

3 So in order to do that quickly -- and that's
4 why I did it alone. Because by the time I tried to
5 train somebody in this, I wouldn't have been able to do
6 it in time.

7 So that -- so, yes, I -- the -- each study,
8 including the Camp Lejeune studies, usually has a
9 discussion section where it pulls in that kind of
10 information. So since these studies did do that, just
11 like the Camp Lejeune study, you could use that to get
12 a sense of what the animal data looks like without
13 having to do a lit review yourself. They've done it.

14 Q Right.

15 A So use it.

16 Q And as you just mentioned, if IARC had done a
17 monograph on this chemical, it would have had a
18 separate section for animal data?

19 A Yes.

20 Q And it would have had a separate section for
21 mechanistic data?

22 A Yes.

23 Q So the only thing that you would have been
24 missing was if that was 10 years old, and so if there
25 was mechanistic data in that 10-year period and you

1 didn't pick it up -- and it wasn't in some other
2 epidemiological study, it wouldn't have made it into
3 your analysis --

4 A Yes.

5 Q -- is that right?

6 A Right. Yes.

7 Q Okay. And then am I also correct that the
8 data had a cutoff period of August 2016?

9 A That was the last time I looked at the
10 literature.

11 Q Okay. So if there's been any kind of animal
12 data, mechanistic data, or epidemiological data
13 and/or meta-analyses from August 2016 to the present,
14 that would not be included in your assessment --

15 A Right.

16 Q -- in Exhibit No. 5; is that right?

17 A Yes.

18 Q Okay. And so the conclusions that you reach
19 here were conclusions based on whatever science was
20 available, based on the ones we talked about, as of
21 August 2016 --

22 A Yes.

23 Q -- fair?

24 A Yes.

25 Q Okay. So did you do this -- you said you did

1 this all by yourself?

2 A Yes.

3 Q And you did this in six weeks?

4 A Yeah.

5 Q Had you been working on some of this
6 gathering of data and looking into --

7 A Sure.

8 Q -- these chemicals and diseases before then?

9 A Yes.

10 Q So you had files that you could pull up
11 and --

12 A Yes.

13 Q Okay.

14 A But I was -- that's why I was the only one to
15 do it, because I had -- in order to write a protocol
16 for the cancer incidence study, in order to write a
17 protocol for the mortality studies, you have to also do
18 a literature search and report what the literature is
19 in order to justify why you're doing the study in the
20 first place.

21 So I -- and I also attended that IARC meeting
22 where they discussed trichloroethylene and PCE, so I
23 was there for all the discussions. So I was in a good
24 place to do this. That's why Dr. Breysse tasked me
25 with it.

1 And, again, in order to bring someone else up
2 to speed on that would have taken too long.

3 Q Okay. Have you done any updates on this
4 since 2017?

5 A I've identified -- I think it was the end of
6 last year, I had identified a slew of studies since
7 2017 that would make a different -- an additional -- if
8 we wanted to update this, we could, but there wasn't --
9 there was some talk about doing that, but then it sort
10 of dissipated somehow.

11 But I was able to use some of that material
12 in the "Discussion" sections of the cancer incidence
13 study and the mortality study. For example, there were
14 several studies looking at benzene, and I think it was
15 breast cancer, that were new. And that -- those new
16 studies got included in the discussion for the cancer
17 incidence study and the mortality study. So if you
18 look at the "Discussion" sections, you'll see studies
19 there mentioned that aren't in here because they were
20 done after 2016.

21 Q But in the cancer incidence study, I
22 assume -- correct me if I'm wrong -- that you would not
23 have put in discussions of new data or studies for
24 diseases that you didn't address in the cancer
25 incidence study; is that right?

1 A Well, there wouldn't be Parkinson's, for
2 example.

3 Q Right.

4 A But Parkinson's was discussed in the
5 mortality study.

6 If I didn't see an association, an increased
7 hazard ratio, which is the measure we use, then I
8 probably didn't address it. But even -- for some of
9 the cancers that I didn't see it for the primary tumor,
10 I saw for a histological subgroup sometimes, and then I
11 would bring in the literature for that.

12 Q Okay. Okay.

13 A That was just the cancer incidence study.
14 You don't have histological information --

15 Q From mortality.

16 A -- from the mortality study.

17 Q I learned enough that I knew that.

18 A Yeah.

19 Q Okay. And you state on page 2 of Exhibit
20 No. 5, the last sentence of the second paragraph,
21 "This report represents ATSDR's assessment of the state
22 of evidence at this time," right?

23 A Where is --

24 Q It's the last sentence of the second
25 paragraph on page 2, under "Overview."

1 A Oh, yeah. Yes, yes, yes.

2 Q It says, "This report represents" --

3 A Yeah. Sorry.

4 Q Okay. And that would be, really, August of
5 2016?

6 A Yeah.

7 Q Okay. So on page 3, you refer to MCLs for
8 various chemicals.

9 A Uh-huh.

10 Q Why is an MCL relevant to your health
11 assessment? How do you use MCLs in your health
12 assessment?

13 A Well, it's just -- this was background
14 information so that people -- so that people know what
15 the levels -- the maximum contaminant levels that were
16 adopted -- most of them were adopted, for these
17 chemicals, in 1989 or 1991, around that period -- what
18 the levels were and what was at Camp Lejeune prior to
19 these MCLs being established and -- for comparison. So
20 if someone saw 366 parts per billion of something, what
21 does that mean?

22 Q Uh-huh.

23 A A hundred parts per billion of
24 1,2-dichloroethylene is the standard for that. If you
25 see 100 part per billion of TCE, on the other hand,

1 that's a different story. So we put the MCLs in there
2 just for reference so the reader would know.

3 Q Right. And MCL is the maximum --

4 A Contaminant level --

5 Q -- level that you can put in --

6 A -- that's set by the EPA.

7 Q For drinking water, right?

8 A For drinking water, yeah.

9 Q Okay. And so no one can serve drinking water
10 above the MCL?

11 A They shouldn't, no.

12 Q Okay. No one should serve drinking water
13 above the MCL?

14 A For example, in New Jersey, there were water
15 companies that did, and they had to get it down --

16 Q Right.

17 A -- you know. Yeah.

18 Q Okay. So on -- also in -- under
19 "Background," there's references to estimated amounts
20 of water that a Marine would drink. Where did you get
21 that data from?

22 A Well, ATSDR got that data for their public
23 health -- for the Camp Lejeune public health assessment
24 that was published in 2016. There were -- I think
25 there were two different reports that I saw -- I

1 provided that to the health assessment -- which talks
2 about how much Marines drank.

3 So this wasn't from the Marine Corps itself.
4 We didn't ask the Marine Corps how much -- this was two
5 documents that discussed this. That's my -- that's all
6 I can remember.

7 Q Okay.

8 A I don't remember the names of the documents.

9 Q That's okay.

10 A If you go to the Camp Lejeune public health
11 assessment, though, they should list the references.

12 Q Okay.

13 All right. So we talked earlier about the
14 fact that you used EPA, NTP, and IARC for your
15 literature -- not your PubMed, but what they had
16 evaluated for these chemicals.

17 Why did you choose those three bodies for
18 your literature?

19 A Well, because they -- because -- well, IARC
20 is -- that's tasked -- IARC is tasked to evaluate these
21 chemicals for cancers. NTP is tasked to look at these
22 chemicals for other -- not just cancers, but other
23 endpoints. And that's similar for EPA.

24 So since we weren't just focused on cancers
25 here, it would have been important, for example, to

1 look at EPA and NTP. But the other thing is that there
2 are some differences in their assessment, one -- and
3 time differences. Some were more recent than IARC and
4 so on.

5 So it was important -- I thought it was
6 important to look at all the reports by the agencies
7 that are responsible for this, as part of the
8 assessment. Again, to try to limit the amount of time
9 to do this, because if others have -- who I respect,
10 EPA -- I respect EPA, NTP, and IARC -- if others have
11 done that work, I was going to use it.

12 Q And IARC isn't an agency, right? That's an
13 independent --

14 A It's part of WHO.

15 Q Right. But it is a research arm of the WHO,
16 right?

17 A Yeah.

18 Q And so they don't regulate any particular
19 chemicals --

20 A No.

21 Q -- in any --

22 A No.

23 Q -- governmental setting?

24 A I don't think so, no. They're
25 research-oriented.

1 Q Yeah. Okay. And they only look at cancer,
2 right?

3 A They only --

4 Q Right. So as you mentioned, you couldn't use
5 IARC for non-cancer endpoints?

6 A Right.

7 Q Okay.

8 Okay, let's go to the "Classification of
9 Evidence" on page 5.

10 You said you looked at the various ways that
11 these entities classified evidence, and you chose IOM,
12 right?

13 A Uh-huh. Yes.

14 Q And tell us why you chose IOM for this
15 purpose.

16 A Well, I chose -- well, IOM had different
17 classification schemes, one for -- as I said, for
18 Gulf War and Agent Orange, which I think changed over
19 time. But they also had a report specifically for the
20 VA and the presumption program, whatever you want to
21 call it. And so that's what we were tasked to do, is
22 to help them with the presumption list. So I used that
23 classification scheme for that reason.

24 Q Okay. Fair.

25 Okay. So you mentioned earlier -- let's go

1 to page 5 [sic], "Classification scheme categories."

2 A Uh-huh.

3 Q You mentioned -- and my notes are bad, so I'm
4 going to --

5 A We're on page 6, I think.

6 Q I'm sorry. Page 6.

7 A Yeah.

8 Q I'm going to -- my notes are really bad on
9 this. I think you said that everyone agreed or no one
10 disagreed with the classification scheme. Did I get
11 that right? You said something about the
12 classification scheme.

13 A Yeah, I don't recall anyone having a problem
14 with this classification scheme. I think -- you know,
15 they would say why this one and not another one, but
16 they weren't -- they didn't have a problem per se with
17 this one.

18 Q Okay. So let me just go through a couple of
19 things with you on this.

20 So for "Sufficient evidence for causation,"
21 you say, "The evidence is sufficient to conclude that a
22 causal relationship exists," right?

23 A Yeah. Yes.

24 Q So when you use the word "sufficient"
25 there -- I know IARC uses "sufficient" for epidemiology

1 as the highest category.

2 A Right.

3 Q Are you using it in the same context there
4 that IARC would use it, as the highest category of
5 epidemiological evidence, that bias and chance can be
6 ruled out with reasonable confidence?

7 A Yeah, again, they also incorporate animal and
8 mechanistic assessments in that, but -- and since this
9 is focused on epidemiology --

10 Q Okay.

11 A -- it's slightly -- it would be a little bit
12 different. But, no, this would probably be similar.
13 This is strong evidence, I think, that -- you know, for
14 example, kidney cancer, IARC said it was sufficient
15 evidence. I concluded, certainly, that it was too,
16 and, you know, so that -- it does --

17 Q Uh-huh.

18 A It is similar.

19 Q But your scheme also does take into account
20 animal data, because on -- right, because on No. 2, you
21 do -- you can reach sufficient evidence if there's less
22 than sufficient evidence from epidemiological studies,
23 human studies. But there's sufficient evidence in
24 animal studies, which, again, would be strong, right --

25 A Yeah.

1 Q -- strong animal data, and strong evidence
2 that the agent acts through a relevant mechanism in
3 humans --

4 A Yeah.

5 Q -- or what we call mechanistic data?

6 A Yes, I take that into account, but it's not
7 the same as what IARC does, which that's a separate lit
8 review for that and a separate assessment for that.

9 Q Fair.

10 A That's the difference.

11 Q Okay. I understand.

12 Okay, so -- but there's two ways under your
13 scheme that you can reach sufficient evidence --

14 A Yes.

15 Q -- for causation?

16 A Yeah.

17 Q Okay. And then you go -- you explain the
18 considerations --

19 A Uh-huh.

20 Q -- of assessing evidence using Bradford Hill.

21 Can you explain why you chose -- I think
22 there's, like, nine considerations. What is it about
23 the ones you chose that are important to your
24 evaluation?

25 A There's some -- there are viewpoints,

1 suggested viewpoints, by the way, by Hill, and some are
2 more relevant for infectious disease. For example, a
3 specific -- specificity, an infection will cause a
4 specific disease, okay, but TCE might cause kidney
5 cancer, non-Hodgkin's lymphoma, Parkinson's disease.
6 So you wouldn't want to rule any of those things out
7 because it's not specific, that it doesn't cause one
8 disease. So specificity is not relevant --

9 Q Okay.

10 A -- off the top. The -- I'm trying to think
11 of some of the other ones that aren't.

12 Q Maybe you could just say why these are
13 important [indiscernible] --

14 A Yeah, these are --

15 Q -- positive.

16 A -- relevant to the kind of work we're doing.
17 These would be all relevant to environmental and
18 occupational epi studies.

19 Q Okay.

20 A Temporal relationship, of course, would be
21 relevant to anything. If you don't have temporal
22 relationship, you know --

23 Q Right.

24 A -- then -- but the rest are also relevant --
25 some are relevant for infectious disease, but all of

1 these are relevant to looking at occupational or
2 environmental exposures.

3 Q Okay.

4 All right. Then let's look at "Equipoise and
5 above evidence for causation." Before I get -- can I
6 ask you a question? Would you say equipoise would be
7 the same as "as likely as not"?

8 A Yeah.

9 MR. BAIN: Objection, form.

10 MS. GREENWALD: What's the objection?

11 MR. BAIN: Form.

12 MS. GREENWALD: Yeah, but what's wrong
13 with the form?

14 MR. BAIN: Calls for a legal conclusion.

15 MS. GREENWALD: Okay.

16 Q (By Ms. Greenwald) As an epidemiologist, do
17 you have an opinion about whether equipoise would --
18 well, let me ask it this way: What does equipoise mean
19 to you?

20 A The way I explain it to a layperson is just
21 that, as likely as not.

22 Q Okay.

23 All right, so for equipoise and above, this
24 is -- so if it's above equipoise, it would be
25 sufficient; is that fair?

1 A No. There's -- no.

2 Q No?

3 A Just like other classification systems,
4 there's a space there --

5 Q Okay.

6 A -- so, you know, it may be equipoise, but
7 it's not here (gesturing), it's in between, so it's
8 equipoise and above.

9 Q Okay.

10 A That's how I --

11 Q All right.

12 A So maybe the language is a problem here
13 because it's -- it means as likely as not or better,
14 but not to the level of sufficient.

15 Q And you wrote this "Classification scheme
16 categories," right? The sections we're looking at
17 right now --

18 A Yeah.

19 Q -- you drafted these?

20 A Yes, yes, yes. Yes.

21 Q Okay. And then you have -- let me see if I
22 have any other questions about that.

23 So you can have equipoise and above and
24 without sufficient epidemiological studies, right?

25 A Without sufficient evidence. The way I

1 thought about it -- and, again, I think I base much --
2 most of this on the IOM report that pushed this scheme,
3 was if you have one really high-quality epi study, that
4 might be enough to push you over there.

5 For example, the Parkinson's study that was
6 done of -- the earlier one that Goldman did was pretty
7 strong evidence on its own, but not strong enough on
8 its own to go beyond equipoise, you know, so it didn't
9 reach sufficient evidence, just that study alone, but
10 it was -- that -- I would consider it a high-quality
11 study and would push it at least into this category.

12 Q Is that the Goldman 2023 study --

13 A That's the -- no --

14 Q -- [indiscernible] thinking --

15 A -- it's the earlier one.

16 Q -- of the earlier one?

17 A Yeah. It would be referenced here.

18 Q Okay. When Dr. Goldman was -- did he write
19 another paper after the one you're referring to that's
20 referenced here on Parkinson's?

21 A It wouldn't be --

22 Q No, I'm sorry, in addition to the one
23 referenced --

24 A Yeah, yeah. Yes. He did one at
25 Camp Lejeune.

1 Q Okay. And that was when? About 2023?

2 A Yeah, I think that was late 2023, I think it
3 was, yeah.

4 Q Okay. Do you recall talking to Dr. Goldman
5 while he was working on that paper?

6 A On and off, because I gave him the
7 Defense Manpower Data Center data and talked to him
8 about the study. But they had their own researchers,
9 and they did their thing.

10 Q Did he offer to put you on as an author of
11 that paper?

12 A No. He acknowledged me. I wasn't really
13 part of the research team, and so I didn't -- you know,
14 I shouldn't be an author, but he did acknowledge me in
15 the paper.

16 Q Do you remember a discussion with him where
17 he asked if you wanted to be an author of the paper,
18 but there was a discussion between you that it would
19 take too long --

20 A Oh, well, that may --

21 Q -- [indiscernible] ATSDR?

22 A -- we may have discussed it. And everyone
23 knows, I think, that the peer-review process at CDC was
24 a lengthy process. I don't think that's news to
25 anybody, and so -- and I don't know if it's gotten any

1 better, really.

2 So that's what I told him, that it would have
3 to go through our own process and may take years to see
4 the light of day. So -- but it wasn't necessary.
5 Again, I wasn't part of the research team. It was nice
6 of him to ask, but I didn't feel that I should be on
7 the list.

8 Q Okay. And then on page 9, you talk about
9 "Impact of Bias."

10 A Right.

11 Q And then the third sentence under that is
12 "The key limitation of all the studies was exposure
13 misclassification. The impact of exposure
14 misclassification bias would likely be to bias
15 dichotomous comparisons (i.e. [sic], exposed versus
16 unexposed) towards the null if an effect of the
17 exposure is truly present, and to distort
18 exposure-response trends." Do you see that?

19 A Yes.

20 Q So does that mean that if there are people
21 considered in the exposed group who were, in fact, not
22 exposed --

23 A Yes.

24 Q -- that would bias towards the null?

25 A Most likely.

1 Q Okay.

2 A There are rare instances where it could go
3 the other direction. You can't rule it out. But the
4 tendency is in the direction of the null.

5 Q Okay. You mentioned earlier that you've sort
6 of looked at some of the data on these chemicals since
7 you did the 2017 paper.

8 A Uh-huh.

9 Q Are those documents that you left at the CDC
10 when you retired, or did you bring them with you?

11 A I think that everything was put in a box and
12 given to -- I don't have any of them.

13 Q Okay.

14 A But they would be -- a lot of them, also, I
15 had electronically by then.

16 Q Okay.

17 A So I had hard-copy paper studies and also
18 electronically. But all that was left behind. I
19 didn't --

20 Q Do you know what kind of -- what you would
21 have called -- if it was electronic, what would be a
22 likely title or a name for the file if one were looking
23 for it?

24 A I think the file may have been called
25 "Solvents," actually, if I remember right. That's

1 where I had all that literature electronically.

2 Q And how -- if someone were looking for that,
3 how would they be able to see what your update was from
4 the 2017 assessment? Would there be any reference in
5 your files about that?

6 A The list of studies since 2016 would be in
7 that folder.

8 Q In the "Solvents" folder?

9 A Yeah.

10 Q Okay.

11 A That's where I would look for all this stuff,
12 yeah.

13 Q So did you do any analysis, or did you just
14 collect studies and put them in the folder?

15 A I did have -- I drafted an update for the
16 lung cancer, for cervical cancer, and also made
17 changes -- updated the breast cancer --

18 Q Okay.

19 A -- because there were new studies since 2016.
20 And it's all in there, but we didn't go -- it didn't go
21 to peer review. It didn't go any further than a draft
22 because, first of all, I was too busy with the studies,
23 and there was no impetus from the agency to do it. I
24 just couldn't do it on my own. I had to get some kind
25 of sanction to do it.

1 Q Okay. But am I right that, based on what you
2 just said, you didn't do any of that work for any of
3 the Track 1 diseases -- kidney, bladder, non-Hodgkin's
4 lymphoma, leukemia, or Parkinson's disease --

5 A No --

6 Q -- that you recall?

7 A -- because they were done. I thought this
8 was good enough for that. Any new studies are
9 mentioned in the cancer incidence study, because I did
10 see histological subgroups of non-Hodgkin's lymphoma
11 that were elevated, so I discussed that there.

12 Q Okay. I want to get through this quickly,
13 and then I'm told we have to break for lunch. Let me
14 just ask you a couple more questions about the
15 assessment, and then I don't want to be in the way of
16 anyone's hunger.

17 Okay. If you can jump to page 11.

18 A Duration.

19 Q Yeah, "Assumptions on Duration of Exposure."

20 I want to focus on the paragraph that says,
21 "The studies evaluated in this report." And -- I'm
22 going to read it, and then I want to ask you a couple
23 of questions. Okay?

24 It says, "The studies evaluated in this
25 report provide very limited information concerning the

1 level or duration of exposure associated with an
2 increased risk of a cancer or other disease. For
3 example, those studies that evaluated cumulative
4 exposure or exposure duration often used wide
5 categorizations (example, duration of exposure greater
6 than zero to five years). An additional interpretive
7 difficulty is the possible inverse relationship between
8 duration and exposure intensity; example, high exposure
9 intensities may require only a short duration of
10 exposure, whereas low exposure intensities may require
11 longer exposure durations. Although cumulative
12 exposure is a useful metric, it obscures this interplay
13 between duration and intensity. Specifying a minimum
14 duration of exposure also presupposes that there is a
15 known threshold amount of exposure below which there is
16 no excess risk. However, there is no compelling
17 evidence that such thresholds exist for the
18 contaminants and the cancers and other diseases
19 evaluated in this report."

20 Okay, so I want to ask you a couple of
21 questions.

22 When you mention that there's no compelling
23 evidence that such thresholds exist for these
24 contaminants and cancers and other diseases evaluated,
25 is it correct to say that based on your findings,

1 there's no minimum threshold of TCE, PCE, vinyl
2 chloride, or benzene exposure below which a person
3 would be safe from a risk of developing cancer or other
4 disease?

5 A I'm saying that we don't know, basically.
6 There's no compelling evidence. So we don't know where
7 that line would be drawn.

8 It's not like lead, where we have -- you
9 know, lead is a good example. Asbestos might be, but
10 lead is. We don't have that kind of specific
11 information here.

12 If you have a certain amount of lead in your
13 blood, you'll have this kind of outcome and so on.
14 There's nothing like that for almost all exposures --
15 chemical exposures. Even radiation, there's some
16 difficulties there as well.

17 So that's what I'm saying. I'm saying we
18 don't know, basically. There's no compelling evidence
19 to draw that line. And so what agencies do is assume
20 there's no threshold for cancers when they do their
21 modeling, and that's -- you know, it is controversial,
22 but that's what they've done to be on the cautious
23 side. That doesn't mean that it's inaccurate,
24 necessarily, because there may be a threshold
25 somewhere. We just don't know where it is.

1 Q Right. And so just because a study -- just
2 because there's, like, for example, a workers study
3 that shows an effect at -- I'm just going to pick a
4 number -- 500 parts per billion of a chemical and an
5 outcome of leukemia --

6 A Right.

7 Q -- that doesn't mean that that's the
8 threshold; that just means, for example, that that
9 particular study evaluated people at that level and saw
10 an effect?

11 A Yes.

12 Q It doesn't mean that below that number, it
13 doesn't also have an effect --

14 A Right.

15 Q -- fair?

16 A Right.

17 Q Okay.

18 A Yes. I mean, in animal studies, they have
19 enough information they control, it's a controlled
20 experiment, so they can try to make a case for we don't
21 see it at this level, we don't see the -- whatever the
22 outcome they're looking at.

23 So with a controlled experiment like that,
24 you might be able to make a case. I don't -- you know,
25 again, it may not be correct, but you could at least

1 make a case of where that line may be drawn. But in
2 human studies, as I said, the data is not there.

3 Q Right. And would you agree that when human
4 studies don't have that data, in other words, there
5 isn't a study that says, "Oh, this person was exposed
6 to 20 parts per billion and there was no cancer
7 outcome," if that doesn't exist, would one look at
8 mechanistic data to try to understand the mechanism by
9 which cancer occurs?

10 A Sure, if there was such -- and, again,
11 mechanistic information is also very sparse and limited
12 for many of these chemicals. But, yes, if you have --
13 any information like that would be helpful. If you had
14 an animal study, for example, where they actually
15 picked a NOAEL, as they call it, that would be of
16 interest. However, it's an animal, and is it the right
17 animal model for the human? That's a big discussion
18 right there. And is this the right -- is this endpoint
19 relevant to humans? That's another big problem.

20 So even though you have -- it's a controlled
21 experiment and you can draw a line where you don't see
22 the endpoint, its relevance to humans has to be argued.
23 I mean, it's not obvious.

24 Q Right. But some mechanistic studies, you
25 would agree, are -- is done on human blood, is done on

1 human beings, actually, they look at cause and effect?

2 A There are some, yes.

3 Q Okay.

4 A Yeah, yeah.

5 Q Would you agree that even low concentrations
6 of the chemicals at issue here could still pose a risk,
7 depending on other factors like duration or intensity
8 of exposure?

9 A Well, again, it depends on the endpoint too.
10 As I said, with a birth defect, it may not require much
11 at all. It's the timing that's key. For cancers among
12 adults, that's different. So duration is important.

13 The wording here, I notice how this is
14 written, and it could have been written better. High
15 exposure intensities don't require a short duration.
16 The idea here was that you could have high duration of
17 a very low exposure. You can have a long -- short
18 duration with a high exposure, long duration with a low
19 exposure. Cumulative exposure puts them together, so
20 it doesn't tease it out. So, you know, the studies
21 have this problem.

22 And oftentimes why you see differences in
23 studies is how the exposure occurred. Did it occur --
24 how high it was, but also how long it was, and -- so
25 those are issues.

1 Q So, in other words, the level of exposure is
2 dependent oftentimes on the duration of exposure and
3 vice versa?

4 A Sometimes, yes. Sometimes --

5 Q Or it can be?

6 A Yeah, or not. Like I -- right.

7 Q So I read this to suggest, and perhaps I read
8 it wrong, that cumulative exposure alone also wouldn't
9 provide a complete picture of the risk associated with
10 exposure. Is that fair?

11 A Yeah.

12 Q Okay. What additional factors would you want
13 to consider in understanding the full risk of
14 developing cancer from these chemicals or Parkinson's
15 disease other than cumulative exposure?

16 A Well, again, it would be good to tease that
17 out from looking at intensity and duration, as well as
18 cumulative exposure, and seeing what you saw.

19 But in many of the occupational -- in
20 probably most of the occupational studies, again, the
21 categorization of exposure is kind of wide, which
22 doesn't help you. If you're interested in whether one
23 month is enough and the studies look at zero to one
24 year, what are you going to say? I mean, that's
25 been -- that is the problem in trying to do that.

1 And I know -- as I said, NIOSH has done it
2 for the World Trade Center. I've looked at that. For
3 the life of me, I'm not sure how they did it because
4 the studies they are quoting have this problem. And so
5 it's -- it's a limitation of these studies, in a sense,
6 but that's what they have, that's all the data they
7 have. That's all they can do and still see something
8 that's interesting and important --

9 Q Okay.

10 A -- but not for this purpose, to try to find a
11 line in the sand where if you don't have it this much
12 or don't have it this long, it won't hurt you. We
13 don't have that.

14 Q Okay.

15 MS. GREENWALD: I am going to break for
16 lunch --

17 THE WITNESS: Sure.

18 MS. GREENWALD: -- for you all.

19 THE VIDEOGRAPHER: The time is 12:34
20 p.m. Going off the video record.

21 (Lunch recess taken.)

22 THE VIDEOGRAPHER: We are back on the
23 record. The time is 1:32 p.m.

24 Q (By Ms. Greenwald) So welcome back from
25 lunch. I want to move to the cancer incidence study,

1 which I don't have my exhibit number on it. That's
2 what number?

3 A Seven.

4 Q Okay, Exhibit No. 7.

5 This paper hasn't been published in any
6 journal, right?

7 A Not yet. It will be.

8 Q It's awaiting publication?

9 A Yeah. It was accepted in Environmental
10 Health Perspectives about two-and-a-half weeks ago.

11 Q Oh. Congratulations.

12 A Thank you.

13 Q So like the other studies we talked about --
14 we've already talked about the peer-review process for
15 this cancer incidence study, right?

16 A Right.

17 Q Okay. So I just want to ask you a couple of
18 questions.

19 A Actually, the journal went through, I would
20 say, two rounds of peer review on this paper.

21 Q The journal where it's being published?

22 A Yeah, yeah, yeah.

23 Q And do you know why two -- why two rounds?

24 A I think -- well, because it doesn't use
25 significance testing, that might be one reason,

1 although they didn't have a problem with that. And I
2 think because it's Camp Lejeune, I have a feeling that
3 that might be the issue.

4 In the past, Environmental Health
5 Perspectives was not that interested in Camp Lejeune
6 studies, at least back in the day when we were doing
7 the early mortality study, so -- but they've changed
8 their mind, obviously, but, um -- I don't know, they're
9 maybe just being careful. The comments the second time
10 around were mostly stylistic.

11 Q Okay.

12 A So...

13 Q So what is the significance -- excuse me
14 using it twice -- of not using significance testing?

15 A Well, as I said, this is controversy that's
16 existed amongst statisticians for a long time. And the
17 question is: Is it useful to use significance testing
18 to interpret results?

19 And the problem -- I don't want to get into
20 the whole philosophy and theory about it, but it
21 really -- it's both a decision rule and an inference
22 rule, you know, so -- and it's kind of conflated,
23 unfortunately.

24 As a decision rule, it's yes, no, whatever
25 level you pick, okay, so that's -- you know, that's

1 supposed to be a good decision, rule and it's not.

2 And then there's the inference rule, which is
3 how do you interpret a .05 p-value or .10 p-value and
4 so on, and it's not very good at that either. So it
5 fails on both sides -- issues.

6 And so there's a number of reasons why
7 significance testing is problematic. And as I said,
8 unless you really want me to go through some of them,
9 there's -- there's the whole number of articles that
10 were never part of the American Statistical
11 Association's 2016 journal on this, and then there was
12 again -- for the 2019, their final say on it, which was
13 don't use it at all.

14 Q Okay. So this goes back to the -- using the
15 95th percent confidence interval, right?

16 A It -- well, a p-value of .05 and using --

17 Q Okay.

18 A -- 95th percent, kind of same thing.

19 Q Right. Okay.

20 A There's no difference, really.

21 Q Okay.

22 A That's a misuse of the confidence interval,
23 is what it is.

24 Q Okay. If you can turn -- just a couple of
25 questions. We talked about this a lot already, so I'm

1 just going to ask a couple of questions.

2 A Uh-huh.

3 Q If you can turn to the page that, on the
4 bottom, that little Bates number is -- the last three
5 numbers are 106.

6 A 106.

7 Q And on this one, I can actually point you to
8 lines.

9 A Uh-huh, yeah.

10 Q If you can go to line 157 --

11 A Uh-huh.

12 Q -- and 158.

13 A Uh-huh.

14 Q It says here, "The drinking water exposures
15 at Camp Lejeune" --

16 A Right.

17 Q -- "include contributions to total internal
18 body dose from three routes: ingestion, inhalation,
19 and dermal."

20 A Uh-huh.

21 Q When you're talking about that, all of those
22 routes of exposure are from the water at Camp Lejeune,
23 right?

24 A Yes. Yeah. The chemicals are volatile, so
25 you inhale them when you use hot water, any hot water

1 use, and they also have a dermal because they're
2 solvents.

3 Q Okay. If you go to page 117, that little
4 number at the bottom, the Bates number --

5 A 117.

6 Q -- and if you go to line 498 and '99, it
7 says, "This study was approved by the Centers for
8 Disease Control" --

9 A Yeah.

10 Q -- "and Prevention Institutional Review
11 Board."

12 A Right.

13 Q What is that?

14 A It's for human subjects.

15 Q Okay.

16 A So to protect human subjects.

17 Q So would that be true for --

18 A Every study has to go through IRB.

19 Q Oh, so --

20 A That involves human subjects. Even -- yeah,
21 even the mortality study, we have no contact with
22 people. Or this one, we'd have no contact with people.
23 It goes through IRB.

24 Q Okay. I was going to ask if the mortality
25 study --

1 A Yeah.

2 Q So they all go through that. Okay.

3 A Oh, yeah, every -- all -- every study that we
4 did at Camp Lejeune when through IRB, except the
5 assessment of the evidence, which wasn't a study,
6 right.

7 Q So was this like another level of peer review
8 separate and apart from what we've talked about?

9 A They do -- well, in order to protect
10 health -- human subjects, the research needs to be
11 useful.

12 Now, if it's not useful research or done
13 poorly, it impacts human subjects. People are put
14 through an ordeal that they don't need to because the
15 study is not good, worthless, or at least the proposed
16 study is not.

17 So, yes, they -- they do make quite a bit of
18 comments that you would get from a peer-review
19 situation.

20 Q Okay. And then if you look at page 118 --

21 A Uh-huh.

22 Q -- lines 507 and 508, it says, "The median
23 age of the Camp Lejeune and Camp Pendleton Marine/Navy
24 personnel subgroup at the start of follow-up was 35
25 years, and the median age at the end of follow-up was

1 57 years." See that?

2 A Yep.

3 Q And it refers to Table 1a.

4 A Right.

5 Q So this -- am I correct that this cancer
6 incidence study would not reach the median age of many
7 of the cancers that were being looked at for
8 Camp Lejeune?

9 A Right. Yes, it's a young cohort.

10 Q Okay. I want to ask you some questions now
11 about some of the data collection for the cancer
12 incidence study --

13 A Uh-huh.

14 Q -- and I'll try to -- let me just -- can you
15 explain the process by which personnel data for
16 full-time civilian workers at Camp Lejeune and
17 Camp Pendleton were collected for this study?

18 A So the Defense Manpower Data Center -- I
19 think that's what you're talking about -- the Defense
20 Manpower Data Center has personnel records for Marines,
21 Navy personnel, and civilian workers.

22 Q Uh-huh.

23 A The civilian workers' database starts in 1972
24 and have it -- I think it's the last quarter of --

25 Q Uh-huh.

1 A -- 1972. Yeah. And -- however, they didn't
2 include name in the database until sometime in '81, I
3 think it was. So it's, you know -- but they had
4 Social Security number, and so Social Security
5 number -- so it still could be used for that purpose,
6 for the purpose we wanted to use it for.

7 But for some reason, they didn't capture
8 either the full name or sometimes maybe there's a
9 partial -- last name or something, if I remember right.
10 But it was -- for some reason, they didn't collect the
11 full name until '81.

12 Q Okay.

13 A And the -- and then there's a database for
14 Marines, personnel database, which for Marines starts
15 in April -- second quarter of '75.

16 Before that, they had data probably going
17 back to '71, but they did not have the unit code.
18 Without the unit code, you have no idea where they
19 were. The unit code is key to knowing which base they
20 were stationed.

21 Q So what if you -- what if they found someone
22 that didn't have a unit code? They just weren't
23 included in the study?

24 A No, everyone had a unit code --

25 Q Oh, I'm sorry.

1 A -- starting in April '75.

2 Q I see.

3 A If you were -- to be in the study, you had to
4 be at Camp Lejeune or Pendleton --

5 Q Uh-huh.

6 A -- sometime between April '75 and December
7 '85. Those people who started active duty before that
8 time, we didn't know where they were until April '75.
9 Then we have a unit code.

10 Now, there are muster rolls that were
11 computerized by the Marine Corps, and I do that in
12 italics because you can really just do one person at a
13 time. It really was not a -- that kind of a searchable
14 database. At least when I was shown it in Quantico, it
15 was not a database like the DMDC, where you can get all
16 this data together and actually use it. So --

17 Q You didn't use the muster rolls for --

18 A I didn't use the muster rolls at all, no.

19 Q And how -- do you appreciate -- do you
20 understand the difference what -- the kind of
21 information that would be on a muster roll versus the
22 data that would be in the DMDC? Is there a difference?

23 A Yeah. The muster roll would have a lot more
24 information than the DMDC data. It would have -- if
25 would, first of all, say what base you were and your

1 whole record of what you did.

2 And so that's not really available in the
3 DMDC. What's available in the DMDC is, again, the
4 Social Security number, their name, date of birth, sex,
5 race, rank at the time when they were there, the
6 quarter, and a few other things, occupational code and
7 so on.

8 So there's plenty information in the DMDC,
9 but the muster roll will give you more information. In
10 particular, it would tell us what we didn't know. If
11 someone started active duty before April '75, we
12 wouldn't know where they were. The muster rolls tell
13 you.

14 Q Okay. It also wouldn't show, am I correct,
15 if someone was deployed off base at Camp Lejeune?

16 A Yes.

17 Q -- and then came back?

18 A Yeah, it has more information like that. So
19 that's a problem with the -- with all these studies, is
20 that the unit code is helpful, but the person may not
21 be with the -- where the unit is based at that point in
22 time. They may be somewhere else, yeah.

23 Q Okay. What specific data points were -- and
24 you may have answered this and I'm just not fully
25 understanding, but what specific data points were

1 collected for civilian workers and why were they
2 important in assessing cohort characteristics, like,
3 what data points for civilian workers?

4 A Well, as I said, the key ones, for matching
5 purposes with the cancer registries and the National
6 Death Index, would be the Social Security number and
7 the date of birth.

8 Q Okay.

9 A Those two are key. With the Marines, we also
10 had name. That was key.

11 Q Uh-huh.

12 A And sex would be key. So those four
13 variables are the key for matching. And we had at
14 least three of them for the -- for all civilian
15 workers, and four for civilian workers from '81 or so
16 on.

17 Q Okay. And so for the -- for the data
18 points -- now I'm going to talk about Marines.

19 A Uh-huh.

20 Q Would it be the same factors, the Social
21 Security, rank --

22 A For matching purposes, the Social Security
23 number, name, date of birth, and sex, but rank was
24 important. We used that in the model, as well as race
25 and sex. What else, um --

1 Q Why was rank important?

2 A I think rank gives you some sense of -- we're
3 looking for some socioeconomic status type of
4 variables, and rank is one of them. Education level at
5 the time they were there at the base is also an
6 indicator. These are not strong indicators, just the
7 only ones in the database that might be useful.

8 There was occupational code, but that didn't
9 help much. So we really -- we tried to use it, but it
10 didn't really explain anything, so we stuck with the
11 variables of sex, race, education level, and rank. And
12 for the workers, it was their pay grade.

13 Q Okay. Did you choose --

14 A Oh, no, it wasn't the pay grade.

15 Q Okay.

16 A I'm sorry. It was blue collar, yes/no.
17 Yeah. I'm sorry.

18 Q Did you choose to use Camp Pendleton as a
19 comparison to the Camp Lejeune cohort?

20 A Yes.

21 Q And why did -- why did you choose
22 Camp Pendleton?

23 A Wanted a Marine base very similar to
24 Camp Lejeune that did not have contaminated drinking
25 water, and so -- especially contamination with these

1 chemicals. And so Pendleton fit the bill. There were
2 no other Marine bases we could think of that would fit
3 the bill as well as Pendleton would. They're very
4 similar in so many ways, including the activities that
5 go on there and the lifestyle and everything else, even
6 though it's in California.

7 The other thing is that a lot of Marines went
8 to both bases; in other words, they went back and
9 forth. There's that. And, you know, there was some
10 talk about half the -- the middle of the country on to
11 the West went to Pendleton, middle of the country to
12 the East went to Lejeune. But I find that that
13 probably wasn't necessarily the case at all. So people
14 came from all different places to either one of these
15 camps.

16 Q If they went to both, were they excluded from
17 the study?

18 A No, no. No, no, no. The way --

19 Q So how did you factor in -- I'm sorry.

20 A The way we describe it is that if you're at
21 Camp Pendleton, as soon as you go to -- if you move to
22 Camp Lejeune, from then on you're assumed to be Camp --

23 Q Okay.

24 A -- you're characterized as Camp Lejeune. If
25 the other -- the reverse doesn't happen. If you're at

1 Camp Lejeune, then go to Pendleton, you're at
2 Camp Lejeune.

3 Q Okay.

4 A Okay? Because that's the exposure.

5 Q That makes sense. Okay..

6 How does the large sample size at
7 Camp Lejeune and Camp Pendleton contribute to the
8 study's finding of liability?

9 A Well, it gives you more power, statistical
10 power. You'll have more outcomes. Just, you know, if
11 it was -- if it was a smaller cohort with the same age
12 distribution, you would have very small numbers of
13 outcomes. It's a young cohort. The larger you can
14 make it, the better.

15 So we looked at two different sizes. We
16 looked at everyone who -- regardless of when they
17 started active duty --

18 Q Uh-huh.

19 A -- and then we limited it to those who
20 started active duty -- actually, some were -- we went
21 back to December '74, actually, to get as much of the
22 new people in, I mean, people that weren't in the
23 earlier mortality study.

24 So we -- from December to the first quarter
25 of '75, those were new people to the study that were

1 not in the earlier studies.

2 Q Okay.

3 A Just, again, to increase the size because we
4 knew, with cancer in particular, if we're going to look
5 at histological subgroups, it was going to be difficult
6 to interpret.

7 Q So can you explain the process you used to
8 collect the cancer data for the cohorts?

9 A Right. So the first thing -- we had a
10 contractor, Battelle, and their subcontractor was the
11 North American Association of Central Cancer
12 Registries. We call it NAACCR.

13 Q Uh-huh.

14 A NAACCR is the trade group, if you will, or
15 organization of all the cancer -- state cancer
16 registries in the U.S. and Canada. And by having them
17 involved, they were -- at that time, they were starting
18 a program to begin the early stages of having a
19 national registry, at least making it easier to do
20 these kinds of studies, and we gave them Camp Lejeune
21 data to push that effort forward.

22 They were going to look at three cancer
23 registries and get data for us from three, just for a
24 test. And we said, "No, go after all of them," and
25 that -- some started that group.

1 But anyway, so NAACCR helped us -- helped
2 Battelle -- it was very important because the cancer
3 registries trusted NAACCR. They didn't know us from
4 Adam. They're very protective, very protective, as
5 they should be, of their --

6 Q Uh-huh.

7 A -- cancer data. And so it was really helpful
8 to have NAACCR intercede for Battelle and for us so
9 that -- so we -- I gave them those -- the DMDC data,
10 particularly with those variables I mentioned, and then
11 they had a test run with the registries to see how
12 things -- with a few, to see how things worked out, and
13 then they did it with all of them, sent the data to all
14 the registries, including the VA registry.

15 The VA registry was unique in the sense that
16 a cancer registry staff person in Kansas who was
17 extremely familiar with the VA registry actually did
18 the matching, not the VA. The VA couldn't do the
19 matching.

20 The Department of Defense data, cancer
21 registry, I did the matching. That, we spent -- we got
22 all the data from -- I'm jumping around, but we got all
23 the data, the cancer data, from all the states and the
24 VA in mid -- certainly by mid 2020 -- early 2021. And
25 I didn't get the Department of Defense data until,

1 like, September of 2022, so almost a year and a half of
2 going back and forth and back and forth.

3 I think the problem there was that they --
4 they weren't resistant. It was more of their
5 bureaucracy and people not knowing how to navigate
6 their own system, which took forever. But they also
7 said point blank, "We do not do matching."

8 Q This is DOD said that?

9 A Yeah.

10 Q Okay.

11 A Said, "We'll give you" -- they gave me all
12 their data, and then I -- you know, the entire cancer
13 registry data. And you'll see -- if you've gotten
14 those -- my email -- I mean my files, you'll see it
15 there. It was a big dump.

16 What that meant was that -- I had already
17 done the analysis, and then I had to redo it with this
18 new data.

19 So anyway -- so that's how it worked. It
20 worked with the -- I gave the DMDC data to Battelle.
21 Battelle and NAACCR worked with the cancer registries.
22 They did the matching, they all used the same software,
23 except the DOD, because I did the matching --

24 Q Okay.

25 A -- and -- linkage software -- and except for

1 the VA, they all did some sort of quality control,
2 removing duplicates, checking the positive matches and
3 some of the negative matches. They all did that work,
4 which they do, normally, at a cancer registry.

5 Q You say a negative match. In other words,
6 the --

7 A A match that didn't -- I'm sorry, a match
8 that didn't -- a non-match.

9 Q Okay.

10 A They checked some non-matches just to make
11 sure --

12 Q Let me try --

13 A Right. I'm sorry.

14 Q That's okay.

15 So you mentioned -- I think this is clear,
16 but I just want to clarify. When you said "all
17 registries," you're talking about the state registries,
18 not any kind of national registry, right?

19 A There is no national registry.

20 Q Right.

21 A So we used all the state registries. We did
22 not get individual-level data from West Virginia. They
23 had a state law prohibiting it. So did Kansas. But
24 Kansas went this extra step to actually get consent
25 from the patients. So for most of the matches in

1 Kansas, we got individual-level data. There were
2 some --

3 Q Uh-huh.

4 A -- we just got aggregate data, just like
5 West Virginia. So that was unfortunate, but that
6 was -- but all the other states gave us
7 individual-level data, and we could link it to a
8 Social Security number and all the DMDC data, so we had
9 a complete data set to do the study.

10 Q Okay. And I want to make sure I'm right
11 about the VA, but --

12 A Uh-huh.

13 Q -- did the VA do manual reviews?

14 A No.

15 Q Okay. So for those registries that didn't
16 perform manual reviews, like the VA and the DOD, how --

17 A Those are the only two.

18 Q How can you verify the accuracy of the
19 sources coming from those two entities?

20 A How can I verify it? Well, I went through,
21 also, and removed -- I mean the contractor went through
22 and removed duplicates, and then I saw some extra
23 duplicates and removed them as well. So I went through
24 and combed the data myself --

25 Q Uh-huh.

1 A -- to make sure that there were no
2 duplicates.

3 The problem -- part of the problem was that
4 if someone was diagnosed in Kansas and then diagnosed
5 in a neighboring state, they were in both registries.
6 So that's a duplicate, right? So we had to remove
7 that.

8 So, no, we could not check -- in the VA
9 cancer data, we could not check for, as I said,
10 checking the positive matches and checking the
11 non-matches --

12 Q Uh-huh.

13 A -- like the other registries could do, no.

14 Q So I'm just trying to understand --

15 A But that's with the -- I mean, but that's --
16 if -- anything you see from the VA that has to do with
17 cancer, this is what they do. They -- I doubt that
18 they ever take care of that database, and that's
19 probably the reason why we had to get someone from
20 Kansas who knew the database well, because they -- the
21 states use the VA's data. They want to make -- have
22 complete ascertainment.

23 If someone goes to the VA hospitals,
24 sometimes the VA doesn't report that to the State,
25 apparently, and so -- we're not sure how big the

1 problem is, but it's -- the states try to get that
2 information from the VA.

3 Q You were anticipating my next question. So
4 the VA doesn't automatically provide its cancer data to
5 the state registries; is that fair?

6 A I'm not sure I understand -- you may have to
7 ask someone from NAACCR --

8 Q Uh-huh.

9 A -- in particular about this or the CDC's
10 cancer group. But it's -- it's a -- I think for some
11 states, there is cooperation; and for some states,
12 there isn't. That's my understanding. But we -- but
13 the idea was to get the VA data so we wouldn't be
14 missing any cases because of that.

15 Q Okay. So you had the full VA data set and
16 then --

17 A Well, they did the -- as I said, the
18 matching --

19 Q Right.

20 A The VA's cancer data was used to do the
21 matching, just like any registry.

22 Q Okay.

23 A So -- yeah.

24 Q So I think you've answered this, how you
25 dealt with duplicate records. Was that the contractor

1 who did -- dealt with duplicate records except for --
2 you to DOD, right?

3 A Well --

4 Q To the extent there were duplicate records.

5 A -- the data I get from any contractor, I
6 always go through and --

7 Q Okay.

8 A -- I do extra cleaning because you never get
9 an entirely clean data set, in my experience. So they
10 did their job in getting rid of as many duplicates as
11 they saw, but I saw additional ones, and so those I
12 took out.

13 So if there was a lung cancer at one date and
14 then three years later there's another -- the same lung
15 cancer, again, that's a duplicate, you know. They
16 missed some of those. I didn't.

17 Q Okay. All right.

18 Let me just show you one more document. This
19 is a study with your name on it. And am I correct that
20 this is a study that you did when you were with the
21 New Jersey Department of Environmental Health?

22 A Yeah. But by the time this was published, I
23 was already at ATSDR --

24 Q Okay.

25 A -- I'm pretty sure. What's the year on this?

1 Q I think --

2 A Yeah. So, yes, I definitely was. Yeah.

3 Q But this was based on the work you did while
4 you were --

5 A Yeah, I helped Perry -- first of all, they
6 used my assessment of the contamination, so the
7 exposure assessment here is mine. I also showed Perry
8 how to do the analysis. So that's -- that was my
9 contribution to this. This is -- we did an earlier
10 study. I was the third author there because I came in
11 late into the study. Dr. Fagliano was the last --

12 Q Uh-huh.

13 A -- was the lead on that, and I did the
14 Poisson regression in that study.

15 So, yes, both of these were done -- either I
16 was helping them while I was still in New Jersey and
17 then I left and they continued the study, or I was -- I
18 did it entirely in New Jersey, depending on the study.

19 Q Okay. And I want to make sure I'm -- and
20 this looked at both TCE and PCE and trihalomethanes,
21 right?

22 A No.

23 Q No?

24 A Just trichloroethylene and perchloroethylene.
25 This -- the birth defect study looked at --

1 Q Okay. Okay, so this is just TCE and PCE --

2 A Right.

3 Q -- in that particular study?

4 A Yeah, yeah. On the previous one as well.

5 Q Okay. And did you average those together in
6 coming up with your -- let me get to the right table.
7 Just a minute. If you go to Table 2.

8 A Table 2. Okay.

9 Q Do you have -- this is actually -- let me
10 withdraw that question because I see right here it says
11 TCE. So Table 2 only addresses TCE contamination --

12 A Right.

13 Q -- is that right?

14 A There's one that there's a typo, where it
15 says TC -- I thought. I seem to remember there's one
16 that says TCE when it should have said PCE.

17 Q Okay.

18 A Yes, Table 4.

19 Q Okay.

20 A It says, "TCE exposure (ppb)." It should be
21 "PCE." So they were evaluated separately.

22 Q So Table 4 is actually PCE, not TCE, correct?
23 Is that what you're saying?

24 A Yeah. Perchloroethylene, yeah.

25 Q Okay. Sorry.

1 A So first we looked at the trichloroethylene,
2 we looked at the --

3 Q All right.

4 A -- leukemia and non-Hodgkin's and
5 perchloroethylene.

6 Q Okay. So looking at page 559 --

7 A Uh-huh.

8 Q -- for NHL --

9 A Uh-huh.

10 Q -- I just want to make sure I'm reading this
11 right. For concentrations in -- this is drinking
12 water, right?

13 A Yes.

14 Q Okay. For concentrations in drinking water
15 between .1 part per billion and 5 parts per billion,
16 you saw a relative risk of 1.28 for males and 1.02 for
17 females?

18 A Yeah. Uh-huh.

19 Q Okay. And this is for NHL?

20 A Yes.

21 Q Okay.

22 A Total -- all NHLs, and then we have them
23 defined by grade.

24 Q Right. And then you have them broken down by
25 subparts -- subtypes --

1 A Yeah.

2 Q -- excuse me, right? Okay.

3 A By grade, yeah. I didn't do that in our
4 cancer incidence study. I separated them by
5 histological subgroup, which I thought was more
6 informative.

7 Q Okay. So let me go to PCE now --

8 A Uh-huh.

9 Q -- on Table 4 --

10 A Uh-huh.

11 Q -- which I understand you've just corrected.
12 The "TCE" is actually "PCE" on page 560.

13 A Same problem with Table 3, by the way.

14 Q Oh, okay. We'll look at that too.

15 A Change the T to a P on Table 3 and Table 4.

16 Q So Table 3 is also P?

17 A Yeah.

18 Q Okay.

19 A One and two is TCE.

20 Q Okay. So if you look at Table 4, so for PCE
21 for NHL --

22 A Uh-huh.

23 Q -- between .1 part per billion and 5 part per
24 billion, the relative risk for males is 1.25; is that
25 correct?

1 A Yeah.

2 Q Okay.

3 A And for females, it's .95.

4 Q Right. And for 5 parts per billion and over,
5 it's 1.10 for males and 1.08 for females?

6 A Yes.

7 Q And, again, underneath there, there's
8 differentials for the various grade of NHL, right?

9 A (Nods head affirmatively.)

10 MS. GREENWALD: Okay. I don't have any
11 more questions for you right now.

12 THE WITNESS: Okay.

13 MS. GREENWALD: Oh, I didn't put a
14 sticker on your copy. So this will be
15 Exhibit -- thank you -- Exhibit 18.

16 (Exhibit 18 marked for identification.)

17 MS. GREENWALD: Thank you very much for
18 your time this morning and early afternoon.
19 I will ask the witness --

20 MR. BAIN: You want to keep going, or do
21 you want to take a break?

22 THE WITNESS: Sure, if it's okay.

23 EXAMINATION

24 BY MR. BAIN:

25 Q Okay, Dr. Bove, my name is Adam Bain, as I

1 introduced myself to you earlier today. I represent
2 the United States in the case. And I'm going to ask
3 you some questions about your Camp Lejeune studies.

4 A Okay.

5 Q First of all, what percentage of your work
6 over the past 15 years would you say has been devoted
7 to Camp Lejeune?

8 A Past 15 years, so that goes back to 2009, I
9 would say a major portion. I also worked on the PFAS
10 stuff as well, which also took some time, but I think
11 Camp Lejeune was the major.

12 Q So it would be over 50 percent?

13 A Oh, yeah. Oh, yeah.

14 Q Now, I know we're focused on the five
15 diseases that --

16 A Uh-huh.

17 Q -- Ms. Greenwald mentioned, but I do want to
18 go back to some of your earlier studies just to get
19 some methodological issues --

20 A Uh-huh.

21 Q -- clarified.

22 So I think I want to start with what I
23 believe is, and correct me if I'm wrong, the first
24 Camp Lejeune epidemiological study, which was -- would
25 that be the birth defects and childhood cancer study?

1 A That's the first one, except for there was a
2 study done by -- what's her name -- Nancy Sonnenfeld,
3 which was part of her dissertation, which looked at
4 birth outcomes, but that was prior to the water
5 modeling being done.

6 And so there was -- there was a major error
7 in assuming that Holcomb Boulevard was unexposed when
8 they -- there was a period of time before 1972 when it
9 actually received Hadnot Point water. So we redid it
10 for that reason, but -- so based on the water model,
11 that was the first study, yes.

12 Q Okay.

13 MR. BAIN: So I'd like to make this the
14 next exhibit, which I believe would be
15 Exhibit 19.

16 (Exhibit 19 marked for identification.)

17 Q (By Mr. Bain) Dr. Bove, can you identify
18 Exhibit 19 as the birth defects and childhood cancer
19 study --

20 A Yes.

21 Q -- that we were just referencing?

22 A Yes.

23 Q And this was published in the journal
24 Environmental Health; is that right?

25 A Yes.

1 Q And you're listed as the author, along with
2 Perri Ruckart and Morris Maslia?

3 A Yes.

4 Q What was your role as compared to
5 Perri Ruckart and Morris Maslia?

6 A My role was to sort of direct the study and
7 to -- initially we had -- my supervisor was directing
8 the study. I helped with the protocol. But she moved
9 on, and I directed the study. Perri did the
10 statistical analysis. And Morris, of course, did the
11 water modeling. So -- and then I helped with the
12 interpretation, helped with the writing, and so on.

13 Q Okay. And as I understand it, in this study
14 you looked at live births between 1968 and 1985 to
15 mothers who resided on Camp Lejeune during a pregnancy?

16 A Yes.

17 Q And that would have been a case-control
18 study; is that right?

19 A Yes.

20 Q Can you describe what a case-control study
21 is?

22 A A case-control study in particular, in this
23 situation, we identify the cases and then we take -- so
24 that's the case group. And then we take a sample of
25 the non-diseased or other diseases, depending on the

1 kind of study, as your control group.

2 Q Uh-huh.

3 A And you look and see if the -- if the case
4 group has higher exposures than the control group.

5 Q So you had a case group that you found of the
6 particular conditions that you were looking at --

7 A Right.

8 Q -- and then a control group of people who did
9 not have those conditions?

10 A Right, yes.

11 Q And you compared the exposure between the
12 two?

13 A Yeah.

14 Q For the exposure value for the mothers, you
15 used the historic reconstruction of contaminant levels
16 that ATSDR had done through the groundwater fate and
17 transport and water distribution model?

18 A Yes.

19 Q And that's why Morris Maslia is listed as an
20 author; he was the one responsible for that?

21 A Right. In fact, the reason Morris was given
22 that task was for this study.

23 Q And that water modeling provided monthly
24 average estimates of the concentrations of contaminants
25 in the drinking water delivered to certain residences?

1 A Yes.

2 Q Would you agree that there was a data
3 limitation, with respect to the water modeling, because
4 there was a small number of drinking water contaminant
5 results from actual samples that were taken at the
6 water treatment plant?

7 A Well, yes. That's why we had a model, for
8 those reasons.

9 Q Would you agree that the dose calculations
10 generated from the ATSDR's water model are simulated
11 values with uncertainty inherent in such simulations?

12 A Sure, yes. And it's stated so in the
13 documents themselves, yeah.

14 Q So the actual concentrations could have been
15 higher or lower than the values generated by the model?

16 A Well, again, two different things. A sample
17 is a -- is a -- is a point in time. They're averaging
18 over the month. So the highest average -- monthly
19 average for TCE didn't approach the high level of
20 1400 parts per billion from a point sample in 1982. So
21 right off the bat, there are those differences because
22 we're looking at different periods of time, point
23 estimate versus month.

24 But they did try to compare the model
25 estimates with the sample data that they did have, and

1 it was in agreement to the extent that you would in
2 these kind of modeling exercises.

3 Q But you're aware they only had actual
4 sampling from the 1980s and they actually modeled it
5 for decades earlier?

6 A Yes.

7 Q And the models that -- or you don't really
8 know what the actual concentrations were in those prior
9 decades?

10 A Of course not. They did not sample it.
11 They -- yeah.

12 Q And the levels that the model produced could
13 have been either higher or lower than what the actual
14 levels were?

15 A Sure, yes. There's uncertainty.

16 Q Now, to determine residency for the exposure
17 inputs for the study, you used the residential
18 information that you collected during interviews; is
19 that right?

20 A Yes. We also had family housing records as
21 well.

22 Q Okay.

23 A So we used both.

24 Q And you matched that information, using both
25 the residency and the housing records, to the water

1 modeling results to determine concentration levels?

2 A Well, yeah, if the resident was at
3 Tarawa Terrace, for example, we used the Tarawa Terrace
4 values. If they were at Hadnot -- Hospital Point or if
5 they were at any of the Holcomb Boulevard areas, we
6 applied the levels --

7 Q Okay.

8 A -- for that.

9 Q So for both the case group and the control
10 group, were there some people who you determined would
11 be, quote, unexposed within those groups?

12 A Yeah, there were -- there were housing
13 areas where the water was not contaminated.
14 Holcomb Boulevard treatment plant, for example, from
15 '72 on, except for a few periods, was clean, and so
16 that would be -- and then there was variations on
17 levels. So earlier our estimates were lower, then
18 as -- then as time went on, they kept going up.

19 Q Okay. So you divide that -- you divide the
20 people who were in the study, both the cases and
21 controls, into exposed and unexposed groups; and then
22 for those who were exposed, you matched those to the
23 concentration levels in the model?

24 A Yeah, and so we have -- if you see some of
25 the tables, we have different levels of contamination

1 for each of the mothers. So you either had none or --
2 I'd have to look and see what the levels are, but the
3 tables have -- let me see if I can get to the table.
4 Let's see.

5 So Table -- 797, Table 4, for example,
6 unexposed -- so we have unexposed versus exposed.
7 Let's say for PCE, you can see the values there and the
8 numbers and so on.

9 Then we looked at below MCL and above MCL.
10 Okay? So we divided the cases and controls into those
11 categories to see if there were more cases in those
12 categories than controls. But for some, like benzene
13 and clefts, we just looked at unexposed versus exposed.
14 We didn't have enough data to do anything more. And
15 similarly for neural tube defects.

16 Q And did you -- so differentiating into the
17 different levels, were you looking for some type of an
18 exposure-response relationship?

19 A Yes, yes. That strengthens your
20 interpretation if you see that, yes.

21 Q Okay. And do you recall generally what the
22 results of this study were?

23 A The odds ratios for benzene and
24 trichloroethylene were elevated for neural tube
25 defects. For childhood cancers, it was PCE,

1 perchloroethylene. We didn't see anything for clefts,
2 if I recall, which is -- I've seen in other studies
3 that you don't oftentimes see an effect among clefts,
4 so that wasn't surprising.

5 Q Okay. Since we're not really focused on
6 childhood cancers and birth defects, I'm not going to
7 spend too much time on that, but this paper was -- was
8 this paper first submitted to Environmental Health
9 Perspectives?

10 A No.

11 Q No?

12 A No. It was submitted to Environmental
13 Health.

14 Q Okay. And why was it submitted to
15 Environmental Health; do you recall?

16 A Well, it's a good journal. I think at the
17 time, we thought that Environmental Health Perspectives
18 was not interested in Camp Lejeune studies, so that
19 was -- I don't know who -- how that -- who found that
20 out or what. I just heard that from leadership, that
21 they probably won't publish Camp Lejeune work. And
22 why, I have no idea.

23 Anyways, but it was a good journal, and so we
24 decided to send it to them. We could have sent it to
25 an epidemiologic journal, like American Journal of

1 Epidemiology, but this kind of study really fit this
2 journal better than just a straight epidemiologic
3 journal.

4 Q Okay. But do you recall any communications
5 between ATSDR and Environmental Health Perspectives
6 about this study or any of the earlier --

7 A No.

8 Q -- Camp Lejeune studies?

9 A No. I just hear -- it's hearsay, and so we
10 just didn't bother to even try --

11 Q Okay.

12 A -- Environmental Health Perspectives. That
13 was true for the mortality studies back then too.

14 Q Okay. I want to turn to the male breast
15 cancer study that was done.

16 A Okay. Do I have that or --

17 Q I'm going to give you a copy.

18 A Okay.

19 MR. BAIN: Mark this as the next
20 exhibit.

21 (Exhibit 20 marked for identification.)

22 Q (By Mr. Bain) I've marked as Exhibit 20 the
23 2014 study entitled "Evaluation of contaminated
24 drinking water and male breast cancer at Marine Corps
25 Base Camp Lejeune: a case control study." Do you see

1 that?

2 A Yes.

3 Q And you're the author of the study again,
4 along with Perri Ruckart and Morris Maslia and, on this
5 study, also Edwin Shanley?

6 A Yes.

7 Q What was your role on this study?

8 A It was my idea. And also, I developed the
9 protocol. And that's about it. I think that -- and I
10 reviewed the write-up, helped with the write-up, but I
11 did not -- oh, no. I'm sorry. I did do some analysis,
12 yes. The proportional hazards analysis is mine in
13 here.

14 Q And this study was also submitted to
15 Environmental Health; is that right?

16 A Yes.

17 Q Do you know whether it was submitted to any
18 other journals?

19 A I don't think so, no.

20 Q And like the childhood birth defect and
21 cancer study, this was a case-control study, right?

22 A Yes.

23 Q But unlike the birth defect and cancer study,
24 the cases and controls were not limited to those who
25 had been at Camp Lejeune; is that right?

1 A Right. It was all Marines.

2 Q And --

3 A So the -- but the exposure was Camp Lejeune
4 versus all other Marines, yeah.

5 Q Right. So the cases and controls were
6 Marines that were included in VA's Central Cancer
7 Registry; is that right?

8 A The cases were those who were in the Marines
9 and the database, the VA database, who had male breast
10 cancer. And the controls -- we would pick three other
11 cancers that we felt were unrelated to these
12 contaminants as the control group and took those.

13 Q And the controls were those who had a type of
14 cancer that you determined were not associated with
15 solvent exposures, including skin cancer, bone cancer,
16 and mesothelioma?

17 A Right, yes.

18 Q And as with the childhood birth defect and
19 cancer study, you used ATSDR's water modeling as part
20 of the exposure assessment?

21 A Yes.

22 Q And, again, that's why Morris Maslia is
23 listed as an author?

24 A Right.

25 Q And, in fact, if you look at this particular

1 study --

2 A Uh-huh.

3 Q -- it actually includes charts for the
4 different housing areas at Camp Lejeune, right?

5 A Right.

6 Q And those charts are included in the paper as
7 Figures 1 through 7?

8 A Yes.

9 Q Those charts designate different residential
10 areas such as Tarawa Terrace, Knox Trailer Park,
11 Midway Park, Paradise Point, Watkins Village,
12 Berkeley Manor, and Hadnot Point, right?

13 A Yes.

14 Q And you used this data, with information from
15 family housing areas and barrack units, to assign
16 contaminant-specific residential exposure levels for
17 each case and control assigned to Camp Lejeune?

18 A Right.

19 Q However, a case or control, even if assigned
20 to Camp Lejeune, was designated as unexposed if the
21 individual lived off base or in an area that received
22 uncontaminated drinking water?

23 A Right, yes.

24 Q The actual contamination levels during most
25 of the study period were unknown, right?

1 A The sample -- there's no sample data before
2 1980.

3 Q Okay. So the actual contamination levels --
4 what was the -- what was the year of -- the subjects of
5 this study, what were the years at Camp Lejeune; do you
6 recall?

7 A I'm trying to remember. It should be
8 somewhere here. Let's see. Well, we wanted to make
9 sure they were -- the eligible study members were male
10 Marines born before 1969 and diagnosed with or treated
11 for cancer from January 1st, 1995, which is when
12 they -- the VA registry actually started, till
13 May 2013, when I guess the data was last available.

14 So they excluded those born after
15 January 1st, 1969, as those individuals were not old
16 enough to serve during the period of contamination at
17 Camp Lejeune. You have to be at least 17 years --
18 right, so that's -- so they wanted -- so these -- it
19 could have gone back quite a bit, whatever -- if they
20 were diagnosed in the VA registry, right, they could
21 have been at Camp Lejeune in the '40s --

22 Q Uh-huh.

23 A -- for all -- for all I know, or '50s.

24 Q So if you look at page 3 where it says
25 "Exposure Assessment," the first sentence says,

1 "Actual contamination levels during most of the study
2 period are unknown." Do you see that?

3 A Right. Yes. Yes.

4 Q And then if you look at the Table 4 on page
5 12 --

6 A Uh-huh.

7 Q -- the study found some positive hazard
8 ratios above 2, as reflected in Table 4, right?

9 A Right.

10 Q In particular, hazard ratios were above 2 for
11 higher cumulative PCE, TCE, and vinyl chloride
12 exposures?

13 A Right.

14 Q Would you agree that the confidence intervals
15 were very wide for all relationships?

16 A Yes. There were only two cases, for example,
17 and eight controls in the high exposure group for PCE,
18 for example, and something like that for some of the --
19 you know, similar small numbers like that. So when you
20 have small numbers, you have high confidence intervals.

21 Q And I noticed in several of your studies, you
22 refer to confidence interval ratios, or CIRs, right?

23 A Right. We didn't do that for this study.

24 Q Okay.

25 A Yeah.

1 Q What is a confidence interval ratio
2 calculated to reflect?

3 A Okay, well, the ratio is upper limit divided
4 by the lower limit, okay?

5 Q Uh-huh.

6 A And it's a measure of precision. Instead of
7 worrying about where the confidence interval lies,
8 because it can move because of bias, it's trying to get
9 at just the precision issue, just how wide it is --

10 Q Uh-huh.

11 A -- and have a metric that you can use to
12 compare with other studies and other associations you
13 might have. So that's what a confidence interval ratio
14 is.

15 It's been promoted by -- it's new, relatively
16 new, although there is a 2001 paper that advocated for
17 it. And Dr. Savitz, for example, in his book
18 recommends it too, and others have recommended it, and
19 so we use it.

20 Q So is it fair to say the narrower the
21 confidence interval ratio is -- or the narrower the
22 confidence --

23 A The smaller the ratio is, yes, but it also
24 is -- it indicates how narrow the confidence interval
25 is, sure.

1 Q So the smaller the ratio is, the more precise
2 the effect?

3 A Yes. Yes.

4 Q And the more confidence you have in it?

5 A I hate to use that term. It's a poorly
6 chosen term by the people who came up with it. It's
7 just a precision; it means that there's less
8 uncertainty about that point estimate.

9 The focus is on the point estimate, the
10 hazard -- in this case, the hazard ratio; and in the
11 other cases, it's the odds ratio, whatever. And you're
12 just trying to get a handle on what kind of -- how much
13 uncertainty there is about that estimate.

14 So that's what we're trying to do with a
15 confidence interval ratio. And that's what you should
16 be doing with a confidence interval in general.

17 Q Is the confidence interval ratio -- I think
18 you mentioned it's relatively new.

19 A Uh-huh.

20 Q Would I find it in any standard
21 epidemiological references?

22 A I just mentioned one.

23 Q Okay. Which one is that?

24 A Dr. Savitz's book, which I'd have to -- I
25 don't have it in front of -- the title, but it's in

1 second edition, I know that, and it was published a
2 couple years ago. Yeah.

3 Q So it's Savitz's -- he has several books, I
4 know.

5 A Well, this one is on interpreting epi --
6 epidemiological data. I don't know if I referenced it
7 in the cancer incidence study or not. I can't
8 remember. Because I had other references for it. You
9 can see journal articles. I'm wondering if it's -- I
10 mean, the Modern Epidemiology, Volume 4 -- not
11 Volume 4, the Fourth Edition, talks about how to use a
12 confidence interval in similar ways, but they don't
13 actually use the term "confidence interval ratio."
14 They're just basically saying -- looking at the width
15 of a confidence interval, which is what that --

16 Q Uh-huh.

17 A -- ratio is. And similarly, that's what
18 Savitz says in his book. So I think those are pretty
19 standard. Certainly, Modern Epidemiology is the
20 standard book in the field.

21 Q Modern Epidemiology?

22 A Yes.

23 Q Do you consider that to be an authoritative
24 treatise in your field?

25 A Yes.

1 Q Are there any others in the field of
2 epidemiology that you consider to be, you know,
3 authoritative treatises?

4 A Not -- I mean, that is --

5 Q That is it?

6 A That -- to me, that's the most important
7 epidemiological textbook. It's the most difficult as
8 well, but it involves a whole slew of well-known
9 researchers, including top theoreticians in
10 epidemiology. It's always been the standard. Each
11 edition is pretty much the standard.

12 Q And as far as, you know, determining what an
13 appropriate confidence interval ratio is for precision,
14 has that been agreed upon and --

15 A No.

16 Q No?

17 A No.

18 Q So you would not find that specified in any
19 literature, like it needs to be 2 or it needs --

20 A No.

21 Q -- to be 3?

22 A No, no.

23 Q And here in the male breast cancer studies,
24 the confidence interval ratios were well above 3 for
25 all relationships, right?

1 A Right. Some of them are more than 10, yeah.

2 Q Yeah, in fact, some of them were more than
3 20, right?

4 A It may be, yeah. Yeah, yeah, so -- yes. But
5 you can see the width. You could see it. They're
6 wide. I mean, you don't have to calculate a confidence
7 interval ratio.

8 Q And, in fact, you say in the "Limitations"
9 section of the study on page 13, in the second
10 sentence, that "Findings from this study were based on
11 a small number of exposed male breast cancer cases
12 resulting in wide confidence intervals for the
13 estimated ORs."

14 A Right. My view was this was a first look
15 that could be done quickly, although it wasn't done as
16 quickly as I was hoping it would be, because we had VA
17 data. Getting data on -- getting additional data on
18 each of the cases and controls using service records,
19 that took time.

20 Q Uh-huh.

21 A And that probably slowed things down.

22 Q Okay, I'm done with that one now. I'm going
23 to go to the 2014 mortality study, which I think you
24 already have.

25 A Yes.

1 Q Exhibit No. 3.

2 A The first one, yeah. Yeah.

3 Q So I'm showing to Exhibit No. 3. This is
4 entitled "Evaluation of mortality among Marines and
5 Navy personnel exposed to contaminated drinking water
6 at USMC Base Camp Lejeune: a retrospective cohort
7 study," correct?

8 A Yes.

9 Q And you are listed as an author of this
10 study, along with Perri Ruckart, Morris Maslia, and
11 Theodore Larson?

12 A Yes.

13 Q What was your role in comparison to the other
14 authors?

15 A I wrote the protocol, did the analysis, wrote
16 it up, pretty much did almost everything, except the
17 water modeling, of course. Morris Maslia does that.
18 Perri helped with working with the contractor in
19 collecting the data, so I included her. And she was
20 involved in the writing to some extent, or at least
21 editing my writing. And Ted Larson gave me some
22 statistical -- not statistical -- programming codes and
23 helped with the data management.

24 Q Okay. And like the childhood birth defect
25 and cancer study and the male breast cancer study, this

1 was also published in Environmental Health, right?

2 A Right. Yes.

3 Q Is there any reason that you kept submitting
4 studies to the same journal?

5 A We just think it's a good journal that people
6 read, and we were trying to get these results out,
7 disseminated.

8 Q Ms. Greenwald brought up the fact that you
9 had gotten the Ozonoff Award. Do you recall that?

10 A Yes.

11 Q And is it true that David Ozonoff is the
12 founder of this particular journal?

13 A He is one of the two founders. Dr. Grandjean
14 is the other, as far as I understand, yes.

15 Q Did you have any particular relationship with
16 Dr. Ozonoff during this period of time?

17 A No.

18 Q Okay. You did not really know him
19 personally?

20 A Oh, no, I did --

21 Q Uh-huh.

22 A -- years ago. When I worked for Science for
23 the People, he wrote an article for the magazine way
24 back in '76.

25 Q Uh-huh.

1 A So I've known him for a long time. We both
2 participated in a -- in the NAS panel on drinking
3 water. We produced three books, and he was the lead
4 person in that committee, and I was on that committee.

5 So we've worked on stuff before, and we've
6 been interested in toxic waste sites and health
7 effects, so -- but we -- but -- we sent it to this
8 journal not because he was there, but because we felt
9 that the journal would be interested in these and also
10 would be receptive to the idea that they weren't using
11 significance testing to decide what was important and
12 what wasn't.

13 So we figured that that -- this journal would
14 be open to that as well. So for those reasons. And
15 also because, as I said, it is a popular journal for
16 environmental health. It's gotten more popular as time
17 has gone on.

18 Q You were questioned by Ms. Greenwald about
19 the precautionary principle, and you were asked several
20 questions about that.

21 A Uh-huh.

22 Q Would -- the scientists who do not use
23 significance are more in line with those who believe in
24 the precautionary principle?

25 A No.

1 Q Okay. There's no relationship at all
2 between --

3 A Not that I -- no. For example,
4 Sander Greenland, who, as I said, is one of the top
5 theoreticians in the field, is definitely opposed to
6 significance testing. He's been writing about that for
7 years. But I doubt he would be for the precautionary
8 principle. I just don't -- I don't know if he would
9 even have a position on it, for example.

10 Q Okay. Now, this particular study was a
11 retrospective cohort study, correct?

12 A Yes.

13 Q And that's a different type of study from the
14 prior two studies that we looked at, the childhood
15 birth defects and cancer study and the male breast
16 cancer study, right?

17 A Yes.

18 Q And what's the difference between those two
19 types of studies?

20 A This is following a cohort over time to see
21 if they have an event, in this case death --

22 Q Uh-huh.

23 A -- from a particular cause. So in that
24 sense, it's different. You're following two cohorts,
25 basically, the exposed cohort and the unexposed cohort,

1 over time and seeing if -- when the event occurs, and
2 you use proportional hazards for that too. I used
3 proportional hazards in the case-control study. That's
4 not normally done.

5 So for the male breast cancer -- you can do
6 it, and there's papers that tell you how to do it, but
7 most people don't do it. I did it just because I
8 wanted to see if there was anything else we can get out
9 of this information that we had, but -- so what was I
10 saying?

11 Q But it's standard for cohort studies, is
12 that --

13 A Proportional hazards is standard. So are
14 SMRs. And both are in this paper.

15 Q Okay. And for this particular study, you had
16 data from about 154,000 personnel at Camp Lejeune
17 between 1975 and 1985 and about 154,000 personnel at
18 Camp Pendleton during that same period --

19 A Uh-huh.

20 Q - who had not been stationed at Camp Lejeune,
21 right?

22 A Right.

23 Q And this study did not include any individual
24 who began active duty before 1975; is that right?

25 A Right.

1 Q And the deaths in the group at Camp Lejeune
2 were compared to the deaths from the group at
3 Camp Pendleton, right?

4 A Yes.

5 Q And in the abstract on the first page, you
6 report elevated hazard ratios for kidney cancer, liver
7 cancer, esophageal cancer, cervical cancer, Hodgkin
8 lymphoma, and multiple myeloma, right?

9 A Right.

10 Q The only hazard ratio that was above 1.5,
11 however, was for multiple myeloma; is that right?

12 A It looks like that, yes. Yeah.

13 Q It was at 1.68?

14 A Six eight, yeah, yeah.

15 Q All the rest were below 1.5?

16 A Right.

17 Q And the confidence interval for each of those
18 hazard ratios are reported in the abstract, right?

19 A Yes.

20 Q And would it be correct to say that none of
21 the confidence interval ratios for these diseases were
22 less than or equal to 2?

23 A I'd have to look and see. But for all
24 cancers, it was -- it was certainly less than 2. For
25 individual cancers, probably not, because, again,

1 it's -- it was a young cohort, and these are rare
2 outcomes, so I -- no, I don't see it, so no.

3 Q In fact, for cervical cancer, Hodgkin
4 lymphoma, and multiple myeloma, the confidence interval
5 ratios were all well over 3, right?

6 A Probably, yeah. Remember, there are very few
7 women in this cohort to begin with.

8 Q For cervical cancer, right?

9 A Yes.

10 Q I'm going to come back to this, but I want to
11 look at the mortality study for civilian employees --

12 A Exhibit 4.

13 Q -- which I believe is also in here.

14 A Yeah, Exhibit 4.

15 Q Okay. Exhibit 4. So just to identify this,
16 Exhibit 4 is the "Mortality study of civilian employees
17 exposed to contaminated drinking water at USMC Base
18 Camp Lejeune: a retrospective cohort study," right?

19 A Yes.

20 Q And you're listed again as the author, along
21 with Perri Ruckart, Morris Maslia, and Theodore Larson,
22 right?

23 A Yes.

24 Q And would you have had the same role for this
25 study that you had for the study looking at Marines and

1 Navy personnel?

2 A Yes.

3 Q And this, again, was published in
4 Environmental Health, right?

5 A Yes.

6 Q And this is -- the type of study is a
7 retrospective cohort study comparing Camp Lejeune to
8 Camp Pendleton?

9 A Right.

10 Q But for this study, the population was the
11 civilian employees, right?

12 A Right. Yes.

13 Q And where did you get the information about
14 civilian employees from?

15 A Defense Manpower Data Center personnel
16 records.

17 Q And for this particular study, the results
18 were based on data for approximately 4600 full-time
19 workers employed at Camp Lejeune between 1973 and 1985
20 and about 4700 full-time workers employed at
21 Camp Pendleton between '73 and '85 who had not been to
22 Camp Lejeune, right?

23 A Right. In this study, we had less -- we
24 really did not have a problem with people going back
25 and forth between the two bases; where with the

1 Marines, we did.

2 Q Right. Because if you're in the military,
3 you might be --

4 A Right.

5 Q -- changing your station --

6 A Workers tend to stay on the same base, yeah.

7 Q And, again, you compared the deaths with
8 the -- this group between Camp Lejeune and
9 Camp Pendleton, right?

10 A Right.

11 Q And in the abstract, you report elevated
12 hazard ratios for kidney cancer, leukemias, multiple
13 myeloma, rectal cancer, oral cavity cancer, and
14 Parkinson's disease, right?

15 A Right.

16 Q And none of the confidence interval ratios
17 for these diseases was less than or equal to 2, right?

18 A Right.

19 Q And there was only one hazard ratio greater
20 than 2, which was for Parkinson's disease at 3.13,
21 right?

22 A Right.

23 Q And, in fact, in this particular study, the
24 confidence interval ratios were much higher than for
25 the Marine and Navy personnel cohort study, right?

1 A Right.

2 Q And it's because there were fewer subjects?
3 One of the reasons was there were fewer subjects,
4 right?

5 A That's the main reason, yeah. This is an
6 older cohort, so there were -- if there were more
7 workers to study, it may have had a lot more power and
8 narrower confidence intervals, but we were stuck with
9 what we had.

10 Q Because you might have had more deaths to
11 study?

12 A More deaths to study, yes.

13 Q For all the diseases where you reported a
14 hazard ratio of over 1.5, the confidence interval
15 ratios were well over 5, right?

16 A I didn't calculate them, but I can see that
17 they are, for some of them anyway, yeah. For most of
18 them.

19 Q In fact, except for leukemias, all the
20 confidence interval ratios were over 10, some well over
21 10, right?

22 A For what? I'm sorry. Repeat that.

23 Q In fact, for all the results, except for
24 leukemias, the confidence interval ratios were over 10,
25 some were well over 10; is that right?

1 A Again, I'm looking at them -- it looks like
2 that, yes.

3 Q Okay. In both of these two studies, in
4 Exhibit 3 and 4, exposure assessments were done, right?

5 A Uh-huh. Yes.

6 Q And those assessments were done based on
7 ATSDR's fate and transport and distribution models?

8 A Yes. We first compared Camp Lejeune to
9 Camp Pendleton without using the model information.
10 And then we used the model information for residential
11 exposure.

12 Q So there were two type of exposure
13 assessments done?

14 A Well, we decided -- we determined who was at
15 Pendleton and who was at Lejeune based on the unit
16 codes --

17 Q Uh-huh.

18 A -- and did that analysis just straight up
19 with the idea that the residential exposure would be
20 important, but there was also training exposures, which
21 we had no information on.

22 Also, the fact that they had a -- had family
23 housing did not necessarily mean the person lived
24 there. The family may have lived there. The person
25 could be deployed elsewhere.

1 So there were problems with -- just because
2 of those reasons. But we used the modeling for that
3 analysis to see if we could -- what exposure-response
4 relationships we could see given the limitations that I
5 just mentioned. Yeah.

6 Q Okay. Just so I get this straight, is that
7 when you're comparing the -- Camp Lejeune to
8 Camp Pendleton, you don't really need the exposure
9 model for that?

10 A No.

11 Q You're just looking -- you're just assuming
12 everybody at Camp Pendleton was exposed?

13 A No.

14 Q I mean, excuse me, everyone at Camp Lejeune
15 was exposed, everyone at Camp --

16 A Right.

17 Q -- Pendleton was unexposed?

18 A Right. Exactly.

19 Q But you did have the model that had been
20 done, so you looked at --

21 A We felt that we should use the model because
22 it was -- it was -- you know, a lot of work was put
23 into it. We could see what we could see with it, but
24 the -- but because of those limitations I just said --
25 for example, a lot of people either were in housing

1 that didn't get contaminated water or lived off base,
2 but could have been more exposed in training than some
3 of the people who lived on base in Tarawa Terrace, for
4 example. It's -- you know, it depended on where they
5 were training, what their unit was, and so on. And
6 that information, we really didn't have.

7 So there's going to be a lot of exposure
8 misclassification, not due to the modeling, but due to
9 these issues. Okay?

10 Q Yeah. You also mentioned people being
11 deployed when they would be a resident --

12 A Yeah, the unit says they're here, but they're
13 somewhere else.

14 Q Okay.

15 A And, again, without the muster rolls, you
16 really can't tease that out.

17 Q Okay. Well, nevertheless, I want to ask you
18 some questions about that analysis that was done.

19 A Okay.

20 Q So the model produced monthly mean
21 contaminant concentrations of TCE, PCE, and vinyl
22 chloride at Tarawa Terrace, right?

23 A And Hadnot Point.

24 Q Yes. And Hadnot Point, you looked at those
25 chemicals and also benzene, right?

1 A Right.

2 Q As I recall, benzene was not part of the
3 Tarawa Terrace model?

4 A Benzene was not a problem, yeah.

5 Q Okay. And --

6 A The Tarawa Terrace was a dry-cleaner, so they
7 don't use benzene, so...

8 Q Right. So that was perchloroethylene
9 breaking down into TCE and DCE?

10 A Right. And vinyl chloride, yeah.

11 Q And vinyl chloride, right.

12 In the Marine Corps/Navy study, which I think
13 is Exhibit 3 --

14 A Oh, okay.

15 Q -- each Camp Lejeune subject in the study was
16 assigned as exposed or unexposed based on certain
17 information; is that right?

18 A Are you quoting from somewhere?

19 Q Well --

20 A The -- okay, again, there's two different
21 analyses.

22 Q Yeah.

23 A Yes, no, ever at Camp Lejeune.

24 Q Right.

25 A This is -- okay. And then the second

1 analyses takes into account where we thought the units
2 were barracked. Again, we had very little information
3 on that, and the information we did have was from the
4 CAP members and people who had -- other Marines who had
5 recollections. The Marine Corps couldn't help us. So
6 where the barracks were and the family housing records,
7 and all that was used with the modeling results.

8 And, you know, there were some things we
9 didn't know and learned maybe later from the
10 Marine Corps, for example, where women were, were they
11 with their unit, were they at Camp Johnson. We never
12 got a clear answer on that, which added more problems
13 with that exposure-response analysis, using the
14 modeling and the -- and the residential exposure.

15 Q Okay.

16 A So...

17 MR. BAIN: Do you want to take a break
18 now, short break, 10 minutes?

19 THE WITNESS: Sure.

20 MR. BAIN: If you need to.

21 THE WITNESS: Yeah.

22 MR. BAIN: Okay.

23 THE VIDEOGRAPHER: Okay. The time is
24 2:41 p.m. Going off the video record.

25 (Recess taken.)

1 THE VIDEOGRAPHER: We are back on the
2 record. The time is 2:52 p.m.

3 Q (By Mr. Bain) Okay, Dr. Bove, before we went
4 off the record, we were talking about the mortality
5 study among Marines and Navy personnel at Camp Lejeune
6 in comparison to Camp Pendleton.

7 A Uh-huh.

8 Q And we talked about two different type of
9 analyses that you were doing here. One was just
10 comparing the Camp Lejeune to Camp Pendleton groups.

11 A Uh-huh.

12 Q The other was doing an exposure analysis for
13 those who were at Camp Lejeune. And I want to refer
14 you to Figure 1, which is on page 5 --

15 A Right.

16 Q -- of the study. And this shows how you
17 determined how to categorize people for purposes of
18 exposure, right?

19 A For the second analysis, the
20 exposure-response, yes.

21 Q Exposure-response analysis, right?

22 A Yes, uh-huh.

23 Q And so depending on information you had on
24 different individuals, you put them into different
25 categories; for example, you could categorize them as

1 unexposed, based on information, right?

2 A Yes.

3 Q And those who were in the exposed category
4 were assigned a monthly average contaminant
5 concentration based on other information, right?

6 A Based on the modeling information and where
7 they were --

8 Q Okay.

9 A -- with the residences, yeah. Or where --
10 yeah, based on this. If they had family housing
11 records, that was the residence. If they -- if they
12 had different unit codes, we asked the CAP members and
13 other Marines to tell us where units were barracked.

14 Q Okay. So let's go through a couple of
15 examples. For example, if the information showed that
16 a person was married and lived at Tarawa Terrace or
17 Mainside, Hadnot Point, they would be categorized as
18 exposed, correct?

19 A Yes.

20 Q If the information showed that the person --

21 A Hold on.

22 Q Okay.

23 A They would be given a monthly average -- or
24 cumulative exposure based on the monthly averages at
25 that residence.

1 Q Okay.

2 A Okay?

3 Q But they would be considered exposed and then
4 given a monthly average?

5 A Yeah. Yes.

6 Q If the information showed the person was
7 married and residing at Holcomb Boulevard, you would
8 consider them to have intermittent exposures during the
9 summer and spring, right?

10 A Right. Because by the time this study starts
11 in '75, Holcomb Boulevard system is up and running.

12 Q If the information was the person was married
13 and residing elsewhere on base or off base, in other
14 words, not at Tarawa Terrace or Mainside or Holcomb
15 Boulevard, that person was classified as unexposed,
16 right?

17 A Yeah. And, again, this is residential
18 exposures. They could have been exposed in training.

19 Q But for purposes of the exposure-response
20 analysis, they were considered unexposed?

21 A Yes, yes.

22 Q And you made these determinations based on
23 family housing records as well as the name, rank,
24 occupancy, and dates stationed at the base?

25 A Family housing records and unit code and

1 whether they were married or not.

2 Q Okay. So looking at the other side of the
3 figure, if an individual was single, divorced, or
4 marital status was unknown, then you would divide them
5 up into either males or females. So if it was a
6 male --

7 A Uh-huh.

8 Q -- and enlisted, for example, and the
9 barracks were on Mainside, they were considered
10 exposed, but if the barracks were not on Mainside,
11 considered unexposed, right?

12 A Right.

13 Q How did you get the information on which
14 barracks an individual was in?

15 A Again, we asked the CAP members, and they
16 identified other retired Marines who had the knowledge
17 of where units were barracked. We would have liked to
18 get that information from the Marine Corps, but they
19 said they didn't have that information, so we had to
20 rely on that.

21 Q Do you recall where the barracks were that
22 weren't on Mainside, where they were located?

23 A They could have been at the rifle range.
24 They could have been down near the beach area, I forget
25 what it's called, Onslow Beach.

1 Q Onslow Beach?

2 A They could be -- where else would barracks
3 be? There was another -- I'm trying to -- I'm trying
4 to remember the different areas. But there were no
5 barracks at Tarawa Terrace. I don't remember -- there
6 were probably some -- maybe there were some barracks at
7 Camp Johnson. I'm trying to remember. And so
8 that's -- but most of them -- most of the barracks were
9 on Mainside, a majority of them anyway.

10 Q There's a note in Figure 1 that says,
11 "8th Marines" --

12 A Right.

13 Q -- "(both enlisted and officers) moved to
14 Camp Geiger."

15 A Right. We're not sure when. The only
16 information I had was from a CAP member who said they
17 moved in '77, and then the Command Chronologies -- I
18 was able to find a 1980 Command Chronology, which talks
19 about them at Geiger. So 1980, I know they're
20 at Geiger -- I'm pretty sure they're at Geiger, I
21 should say. Before that, I don't -- I'm not sure when
22 they moved.

23 Q And did Geiger have barracks, as far as you
24 know?

25 A Yeah. For the 8th Marines, yeah.

1 Q Okay.

2 A And probably other units too. Yeah.

3 Q And Geiger was considered -- Camp Geiger was
4 considered an unexposed area for purposes of this
5 analysis?

6 A Yes, yes.

7 Q Okay. One more scenario. If an individual
8 was single, divorced, and marital status unknown --

9 A Right.

10 Q -- was male and an officer --

11 A Okay.

12 Q -- if an individual was at the bachelor
13 officer quarters at Holcomb Boulevard, that person had
14 intermittent exposures during the dry spring and summer
15 months, right?

16 A Right. But it could be -- I mean, again,
17 some of the officers may have been -- it's not usual,
18 but they could have been barracked with their unit, but
19 we assumed that they were at the BOQ.

20 Q If the individual was single, divorced --

21 A Divorced.

22 Q -- or unknown marital status and the
23 individual was male and an officer, if the individual
24 was not at the bachelor officer quarters at
25 Holcomb Boulevard, that individual was considered not

1 exposed, right? If you look at the note at the bottom,
2 "BOQs elsewhere on base were" --

3 A Yeah, yeah, yeah. Yes, yes, yes, yes.
4 Sorry. Yeah, yeah.

5 Q That's correct?

6 A Yeah.

7 Q Do you know where the bachelor officer
8 quarters were that weren't at Holcomb Boulevard?

9 A I can't remember.

10 Q Okay. And then you mentioned females earlier
11 in your testimony. And here on this particular figure,
12 there's an indication for females who are single,
13 divorced, or marital status unknown. And it mentions
14 that prior to June 1977, they were barracked at
15 Mainside and considered exposed; but after June of '77,
16 they were barracked at Camp Johnson and considered
17 unexposed. Is that right?

18 A That's what we assumed at this point. But
19 later, talking to the Marine Corps, they said, well,
20 some of the women may have been barracked with their
21 unit.

22 Again, there's a lot of uncertainty not
23 in the water -- the water modeling has its own
24 uncertainty. There's plenty of uncertainty here, which
25 is why I put more emphasis on the -- just a straight-up

1 Lejeune versus Pendleton comparison.

2 Q Okay. Do you recall what the June 1977
3 distinction was based on?

4 A There's a document, actually, that says that.
5 That was pretty clear. There was a document about it,
6 and the Marine Corps agreed with that assessment as
7 well. The question was what happens after 6/77, not
8 before, whether they were -- some went to Camp Johnson
9 for sure, but some may have went with their barrack --
10 the unit.

11 Q Okay. So just so I'm clear, with respect to
12 this exposure-response analysis only, is what I'm
13 focusing on --

14 A Uh-huh.

15 Q -- the people who resided off base were
16 considered to be unexposed, right?

17 A Right.

18 Q The people who resided at Camp Geiger were
19 considered to be unexposed?

20 A Right.

21 Q The people who resided at Camp Johnson were
22 considered to be unexposed?

23 A Right.

24 Q But as you mentioned, another analysis that
25 you did comparing Camp Lejeune to Camp Pendleton, you

1 assumed everyone at Camp Lejeune was exposed to
2 contaminated drinking water at their residence or
3 during daily activities, while those at Camp Pendleton
4 were unexposed, right?

5 A Right.

6 Q Did you consider removing the people who
7 resided off base from the analysis comparing
8 Camp Lejeune to Camp Pendleton?

9 A No.

10 Q Why not?

11 A Because they could have been exposed in
12 training, as I said before. And, in fact, they might
13 have been more exposed in training, depending on the
14 kind of training they were doing and where they were
15 training, because the water buffaloes that were used at
16 Hadnot Point, sort of a general area where a lot of the
17 training was, came from the Hadnot Point system, so --
18 and they also showered on site too.

19 So they could have had at least -- certainly
20 if someone had residential exposure and training
21 exposure, they have higher. But it could be that some
22 of the people, residential exposure wasn't that high
23 and the training exposure could have been higher.

24 So for all those reasons, we -- I felt that
25 the straight-up comparison made sense.

1 Q And for the same reason, you did consider
2 removing the people who resided at Camp Geiger or
3 Camp Johnson from the comparison analysis?

4 A The -- that's -- I think what happened there
5 was I looked at a number of different scenarios, and
6 that was true for the mortality study here.
7 8th Marines at Geiger, 8th Marines not at Geiger, and
8 looked at it in those ways.

9 So if they were -- so for the analysis where
10 I looked at Lejeune versus Pendleton and I decided to
11 put 8th Marines at Geiger, then they wouldn't be at
12 Camp Lejeune. They would be out of the -- out of the
13 study. But for the main analysis, they're all in.

14 Q Even if they're at Camp Geiger?

15 A Even if they're at Camp -- well, for the
16 8th Marines, they're kept in, yes.

17 Q And what about people at Camp Johnson?

18 A Camp Johnson is always in.

19 Q Okay. And why are you making the distinction
20 between Camp Geiger and Camp Johnson?

21 A Camp Johnson, there was a connection with
22 Tarawa Terrace of sorts. And even some people think
23 that there might have been some exposure over there.
24 But the reason -- the main reason is that the Camp --
25 and the reason the VA counts the whole area as

1 Camp Lejeune and exposure is because people don't stay
2 at Geiger. They come in, they're -- a lot of the
3 facilities are at Hadnot Point. And so they would get
4 exposure if they came in and ate in the commissary or
5 whatever.

6 So -- but, again, that's part of the exposure
7 misclassification I talked about earlier. No matter
8 which way you do these -- this analysis, you're going
9 to be faced with those problems.

10 Q Uh-huh.

11 A There's no question about it. And then you
12 have to figure out how bad it is and what it might mean
13 for the interpretation.

14 Q With respect to the information that you
15 mentioned about people at Camp Geiger going to
16 Mainside, what was that based on?

17 A Just what -- discussions with the
18 Marine Corps. There was -- there's no documents, no.

19 Q With respect to people training and using
20 water buffaloes from Hadnot Point, what was that based
21 on?

22 A Again, discussions with the Marine Corps.

23 Q Any particular people in the Marine Corps who
24 were giving you that information?

25 A Well, Scott Williams -- I've had a lot of

1 conversations over the years, so some of this
2 information probably came from him.

3 Q What about from Jerry Ensminger?

4 A Jerry Ensminger, of course, and other CAP
5 members.

6 Q Okay. Let's go back to the exposure-response
7 analysis --

8 A But when I say "Marine Corps," I'm talking
9 about Scott Williams --

10 Q You're talking about --

11 A -- not Jerry Ensminger.

12 Q Okay.

13 A When I talk about the CAP, I mean
14 Jerry Ensminger --

15 Q Okay.

16 A -- and others on the CAP.

17 Q Okay. But you received information from
18 both?

19 A I received information from all kinds of
20 people. But the Marine Corps, in particular,
21 Scott Williams was our point of contact. So a lot of
22 information from him, a lot of information from the
23 CAP, a lot of information with people who were retired
24 Marine Corps calling me about their health and then
25 talking to me about the situation there. I tried to

1 get information every which way because I could not
2 count on the Marine Corps to give me information that I
3 needed all the time.

4 Q Uh-huh. Okay.

5 Going to the exposure-response analysis, with
6 respect to those who were considered exposed -- we've
7 talked about this before -- you determined cumulative
8 exposures --

9 A Uh-huh.

10 Q -- that were expressed in
11 microgram/liter/months for each contaminant and for
12 total contaminants, right?

13 A Right.

14 Q And that was based on average contaminant
15 concentrations in the water system serving the
16 individual's residence?

17 A Uh-huh. Yes.

18 Q And those concentrations are based on the
19 values generated by ATSDR's water model, right?

20 A Yes.

21 Q And the cumulative exposure number was based
22 on the length of a person's occupancy at the residence?

23 A Right. Or the barracks where their unit was
24 if they were single, for example.

25 Q Okay. And how was the length of the

1 residency determined?

2 A How was the length of the -- we had
3 concentrations for each housing, for each water system.

4 Q Uh-huh.

5 A Okay? So if you were barracked at
6 Hadnot Point, you got the Hadnot Point values. If you
7 were barracked elsewhere, you were either unexposed --
8 or if you lived in family housing in Tarawa Terrace, of
9 course, you'd get that, and then so on.

10 So -- and Holcomb Boulevard, if you lived
11 there, it -- you got some contamination on occasion.
12 We took that into account. So you'd have probably on
13 the low end of the cumulative exposure, because most of
14 the time the water was clean.

15 Q But did you assign a cumulative exposure to
16 each individual --

17 A Yes.

18 Q -- in the study?

19 A Yeah. Well, I mean, for Pendleton, they'd
20 have zero.

21 Q Right.

22 A People who were unexposed, they'd have zero,
23 but yes.

24 Q I should have been more specific. For each
25 exposed person --

1 A Yes.

2 Q -- in the study, you had a cumulative
3 exposure?

4 A Right, we had a cumulative exposure.

5 Q So was that also based on how long that
6 individual was at that particular area?

7 A Yes.

8 Q So it's not only the average concentration
9 for the area, but how long that --

10 A Duration, yes. Yeah, uh-huh.

11 Q And to determine how long that person was
12 there, what information did you use?

13 A The DMDC data. For family housing, the
14 family housing records. That's all we had. Yes,
15 that's all we had.

16 Q Were you able to take into account a Marine's
17 deployment off of Camp Lejeune?

18 A No.

19 Q So for purposes of this analysis, you assumed
20 that the DMDC data represented continuous presence at
21 Camp Lejeune?

22 A For the quarters that they were there, yeah.
23 For the quarters that they're in the DMDC data with
24 their unit code that corresponds to Camp Lejeune, yes.

25 Q But you're aware that a Marine could be

1 deployed overseas while the DMDC data represented a
2 duty station at Camp Lejeune?

3 A Overseas, other -- they're training at other
4 basis. During the survey, we heard that from some
5 Marines, yeah.

6 Q And what significance would that have in the
7 exposure-response analysis?

8 A Well, that is exposure misclassification. It
9 could distort the -- instead of a line like this
10 (gesturing), it could go like this (gesturing). It
11 could go, you know, all kinds of different ways because
12 of the exposure, but usually what happens is it goes
13 like this (gesturing).

14 The upper people -- or more exposed people
15 tend to be put in the middle and -- but it could go the
16 other way. It could go any which way, and that's why
17 it makes it even more difficult, when you have exposure
18 misclassification, to interpret an exposure-response
19 relationship, because the curves are funny that way.

20 Q Yeah.

21 A And, in fact, they used splines to capture
22 that. I'm pretty sure I did it in this study. Yeah,
23 yeah, I did.

24 Q Okay. And I'm going to move so some
25 questions regarding that now.

1 A Uh-huh.

2 Q So, generally, seeing an increase in effect
3 as the dose of exposure increases supports a conclusion
4 of causality, right?

5 A It's more evidence, yeah. Yeah, yeah. Yes.

6 Q But if you don't see an increase in effect as
7 the dose of exposure increases, the dose-response
8 analysis does not support a conclusion of causality?

9 A You could take that position, or you can say
10 that there was exposure misclassification and it's hard
11 to interpret. You get more information if you see a
12 monotonic straight relationship. If you don't see it,
13 it doesn't -- obviously it doesn't provide much support
14 for what you've seen already, but it doesn't
15 necessarily oppose that. It's just not helpful.

16 Q Right. I'm not saying it opposes it. It's
17 just not providing support?

18 A Yeah, right. It doesn't provide additional
19 support, no.

20 Q Now, in this report, you distinguish between
21 monotonic exposure-response trends and non-monotonic --

22 A Right.

23 Q -- exposure-response trends, right?

24 A Right.

25 Q And can you describe the difference between

1 the two?

2 A A monotonic relationship is an increase with
3 every increase in dose. It could stay level for a
4 period, but it can't go down.

5 So as I said, some of the curves, you'll see
6 it go like this (gesturing). That's not monotonic. It
7 has to either be straight like that (gesturing), or it
8 can be like this (gesturing) --

9 Q Uh-huh.

10 A -- but it -- okay? So it can't change
11 direction.

12 Q (Gesturing.)

13 A Right.

14 Q So, for example, if you have three or more
15 exposure values, a monotonic trend means each
16 incremental higher exposure has either the same effect
17 or an incremental higher effect?

18 A Exactly.

19 Q But for a non-monotonic trend for three
20 exposures means that each of the incremental higher
21 exposure shows a higher effect from the lowest
22 exposure, but they aren't incremental where the highest
23 exposure category is always the highest effect?

24 A It -- the shape could be any which way, you
25 know. It's unclear. That's all I can, you know -- so

1 with exposure misclassification, it can look any way.

2 Q What is the basis for a non-monotonic
3 exposure trend supporting causality?

4 A If you have some -- for example, if the curve
5 goes like this (gesturing), you may have some
6 additional information that says that at a certain
7 level of exposure, you don't produce any more cases,
8 you've reached the limit -- the saturation --

9 Q Uh-huh.

10 A -- for example. So if you have additional
11 information to explain the non-monotonic relationship,
12 then that actually might be supportive even. Without
13 that, I would say that it doesn't really -- it doesn't
14 add additional support, a non-monotonic relationship.

15 Q Okay.

16 A But if you see -- if you see -- if you can
17 figure out what's going on -- if you see something like
18 this and then it goes up and it's definitely higher in
19 the higher exposure group, it could be that you needed
20 more exposure for an effect to be actually seen in
21 this -- in that study. So, again, it's not a
22 dichotomous cut, yes, no, provide support.

23 Q Uh-huh.

24 A You know, if you have additional information
25 or can explain the curve, it might provide support.

1 Okay?

2 Q So if you have a non-monotonic trend, you
3 would need additional information to --

4 A I would say it would help, yes. Yeah.

5 Q Okay. If you look at Table 7 on page 10 --

6 A Table 7 on page -- yeah, right here. Uh-huh.

7 Q -- you report the exposure-response
8 relationship for certain chemicals and certain
9 diseases. Do you see that?

10 A Yes.

11 Q And some of the relationships are monotonic
12 and some of the relationships are non-monotonic, right?

13 A Right.

14 Q So the only monotonic ones that I see are
15 total VOCs in kidney, TCE in Hodgkin --

16 A Uh-huh.

17 Q -- benzene in Hodgkin --

18 A Uh-huh.

19 Q -- TVOC in Hodgkin, and PCE in ALS. Does
20 that look right to you?

21 A Uh-huh, right.

22 Q And the rest are --

23 A Well, if the initial -- if any of them are
24 below 1, that would not make it a monotonic. So .69
25 would make it not monotonic.

1 Q Okay. So it has to be at least 1?

2 A Yeah, it has to be at least 1, so that's
3 not -- I wouldn't consider that monotonic.

4 Q So you're talking about PCE in ALS, right?

5 A Right. So none of the ALS ones -- yeah, none
6 of the ALS ones are monotonic, I would say. The only
7 interesting thing about the ALS was at the high
8 exposure level, cumulative exposure level, we had odds
9 ratios that were pretty high there, but it wasn't --
10 and, again, you could say something about that. It
11 goes as far as -- it doesn't go that far, but it does
12 provide some indication.

13 Q So Table 7 is somewhat selective in that you
14 did not report the exposure-response relationships for
15 many of the chemicals and many of the diseases, right?

16 A Right.

17 Q Would it be fair to assume that the
18 relationships that were not reported in Table 7 did not
19 exhibit any type of exposure-response relationship?

20 A Yeah, I think that -- I must say something
21 about that in the -- well, there was an additional
22 file, that's right, an additional file that had all the
23 splines and all the results. So, yes, these are the
24 ones I highlighted, but all the results were in the
25 supplemental file.

1 Q So, right, the ones that you highlighted here
2 were the only ones that showed an exposure-response
3 relationship, increasing exposure-response
4 relationship?

5 A Yeah, but I also put them -- for kidney
6 cancer, I was going to do it anyway because of the
7 trichloroethylene.

8 Q Uh-huh.

9 A Hodgkin's lymphoma, we don't have much
10 information on Hodgkin and these chemicals.
11 Non-Hodgkin's is different.

12 Q So you mentioned -- is there reference to a
13 supplemental file in the report that was provided to
14 the journal along with the article?

15 A Yeah, they have -- they had all of it, yes.

16 Q And that would have shown all the
17 relationships?

18 A Yes. I think it says that on page -- well,
19 1111, "Analysis internal to the Camp Lejeune cohort:
20 Full results for categorical and continuous cumulative
21 exposure are in Additional File 2, Additional File 3."
22 It looks like -- I think the splines are there too.

23 Q What page are you referring to?

24 A It -- in the bottom, it's -- the last four
25 digits are 1's, 1111. At the top it says, "Page 9 of

1 14."

2 Q Okay. I see it.

3 A Yeah, let me just see. I'm sure I did --
4 yeah. Yeah, I did splines. Yeah.

5 Q And, again, if there isn't an
6 exposure-response relationship, that factor cannot
7 provide a support for a finding of causality, right?

8 A Unless -- unless with the caveat I said, that
9 if you have additional information, then you might be
10 able to explain why it's not monotonic.

11 Q Right. But if there isn't either a monotonic
12 or non-monotonic relationship, but -- nothing there at
13 all, then it doesn't provide support for causality?

14 A Unless it's -- yeah, if it's a monotonic, it
15 does. If it's not monotonic, then in that situation it
16 wouldn't. Yes.

17 Q And so what is the universal relationships?
18 There's monotonic, non-monotonic. What would you call
19 everything else?

20 A Those are the two. It's either monotonic or
21 non-monotonic.

22 Q What if it's going down? As the exposure
23 increases, the effect --

24 A Well, the idea of monotonic is it's
25 increasing unless -- the hypothesis is that it's

1 protective, and that's the hypothesis. Then going like
2 this (gesturing) would be similar to if it went like
3 this (gesturing) for a positive hypothesis -- in other
4 words, if the hypothesis is this chemical protects you
5 from ALS --

6 Q Uh-huh.

7 A -- for some reason, and you have this
8 (gesturing,) that's strong evidence. Okay?

9 If it's TCE in kidney cancer, you would want
10 to see -- I'm using the same hand -- you like to see it
11 going this way (gesturing), right? So it depends on
12 the hypothesis too.

13 So that's why I say if it's less than zero --
14 because the hypotheses we're evaluating are not
15 protective. We don't assume these are protective of
16 anything. We assume that either they don't have an
17 effect at all or they're going to have an effect if it
18 was -- but there are instances where some things are
19 protective. In fact, I think smoking -- was it smoking
20 and Parkinson's? I think I wrote about that. Yes.
21 The direction went the other way. Yeah.

22 Q So just so I'm clear, on these dose-response
23 relationships, if it's a monotonic increasing trend,
24 that, without anything else, supports causality?

25 A That provides some support, yeah. It's part

1 of Hill's viewpoints.

2 Q Right.

3 A So you can -- you can use that as part of
4 your argument. It doesn't make it definite or anything
5 of the sort.

6 Q Right.

7 A It's just more evidence.

8 Q And if there's a non-monotonic increasing
9 trend --

10 A It would be helpful to have more information
11 or at least -- at least try to explain why you're
12 seeing that and why, by explaining that, you might be
13 able to provide support.

14 Q And if you have any other trend, then it does
15 not support causality?

16 A Well, you wouldn't have any other trend. You
17 either have one or the other. I don't -- it's either
18 non-monotonic, which is not as -- if it -- in other
19 words, it has different shapes, non-monotonic. So it's
20 really monotonic or not, okay? I mean, I don't know
21 what could fit what you're trying to get --

22 Q If it was decreasing, if every level of a --
23 you know, you called it protective and it might support
24 a hypothesis --

25 A If your hypothesis is that it's not

1 protective and the curve is going that way (gesturing),
2 I wouldn't call that a monotonic relationship. It's --

3 Q Or non-monotonic?

4 A All right. Okay, you got me. You could
5 call --

6 Q I'm just trying to understand.

7 A You could call it that. Again, you could
8 call it non-monotonic in the sense that it's not
9 increasing with every increasing dose.

10 Q Okay.

11 A That's the definition of "monotonic."

12 Q I thought non-monotonic at least had to show
13 some increase on the curve, just not a linear increase.

14 A Well, it can go down. You look at some of my
15 splines, they go below 1.

16 Q Uh-huh.

17 A So no.

18 Q Okay. Okay. I think I've exhausted my
19 understanding of that.

20 Let's look at Table 6 on this.

21 A Still on the same -- okay.

22 Q It's on the same page. Page 10 at the top.

23 A There it is, Table 6. Okay.

24 Q Table 6 of this study reflects the
25 "Categorization of cumulative exposure variables within

1 the Camp Lejeune cohort," right?

2 A Right.

3 Q And this shows how many people within the
4 cohort were in each exposure level, right?

5 A Yes.

6 Q What does the reference level indicate?

7 A It's similar to saying they're not exposed.
8 If you -- it's the -- it's where you're comparing it
9 to.

10 Q Okay.

11 A So instead of comparing Camp Lejeune to
12 Camp Pendleton, you're comparing greater than 1,
13 greater than 155, greater than 380 with the less than
14 or equal to 1 group.

15 Q So would it be fair to say that the reference
16 level indicates the people who are at Camp Lejeune who
17 are classified as unexposed for the exposure-response
18 analysis?

19 A For that -- yeah, for residential exposure,
20 yes.

21 Q And so if you look at the TVOC level, which
22 is the one at the -- at the bottom, would that mean
23 that 57,328 people were considered unexposed to any of
24 the chemicals for this analysis because the total VOC
25 number is less than 1?

1 A Well, they would have less than 1. They may
2 have had some -- a tiny bit of exposure. Again,
3 residential, yeah.

4 Q And that represents approximately 37 percent
5 of the entire Camp Lejeune cohort; would that be fair?

6 A Yes. That's what I have there, yeah.
7 Uh-huh.

8 Q Would it have been possible for you to
9 exclude these individuals from the Camp Lejeune cohort,
10 in the analysis comparing the Camp Lejeune cohort to
11 the Camp Pendleton cohort, to reduce the potential for
12 the exposure misclassification?

13 A No. Because, again, they could have had
14 training exposures, and that could be worse, as I said
15 before, than the residential exposure, so no.

16 Just because there's 37 percent without
17 residential exposure -- and this could be -- it's a
18 weak number, as well, given the information. It does
19 not mean that all 37 percent of these people, or even
20 most of them, didn't have an exposure. Okay? So
21 that's why they can't be deleted.

22 Again, the -- this is why I don't do it in
23 the more recent studies. This is problematic. We
24 wanted to use the water modeling as much as possible,
25 but really the water modeling made sense for

1 characterizing people who actually got their exposure
2 almost entirely, if not entirely, residential. And
3 that would be family members who resided in -- on base.
4 Okay? That's -- and that's why we did the water
5 modeling in the first place, was for those studies, the
6 reproductive outcome studies.

7 Q Okay.

8 A Stretching it to fit this study was probably
9 not the best idea because of all these issues. And
10 people would say what you just said, "Oh, well,
11 37 percent were not exposed." That's not true. Okay?

12 Q Because this is based just on residential
13 exposure?

14 A Just based on what information we have on
15 residential, which, as I said, has some uncertainty as
16 well.

17 Q Did you consider doing -- or confining the
18 exposure-response analysis to just those people who had
19 only residential exposure?

20 A I wouldn't know that. Right. I wouldn't
21 know. If I had that information, I would have done
22 something totally different here. That is the problem,
23 is we don't have information on training.

24 Q Okay. Did you do any analysis -- did you do
25 the analysis, run the numbers excluding that group of

1 57,000 people, just to see what it looked --

2 A No. That's the reference group. No. That's
3 the reference -- you need a reference group.

4 Q I know, but going back to the Camp Lejeune
5 versus Camp Pendleton analysis -- and I understand your
6 position that if you were to exclude them, that would
7 be exposure misclassification, but did you do that
8 analysis, did you -- did you look at what that would
9 look like?

10 A So you're saying in the analysis comparing
11 Camp Lejeune and Camp Pendleton, did I remove these
12 people?

13 Q Yes.

14 A No. No, I wouldn't even consider doing that.

15 Q Okay. Let's look at page 12 of the paper,
16 which is the "Limitations" section.

17 In this section, you state that exposure
18 misclassifications could bias hazard ratios in
19 comparison between the Camp Lejeune (exposed) and the
20 Camp Lejeune [sic] (unexposed) toward the null value of
21 1.0, resulting in underestimates of the effects of the
22 exposure, right?

23 A Uh-huh.

24 Q Is that a yes?

25 A Yes. Sorry.

1 Q But as you just said, you didn't do any
2 analysis removing the people who were considered to be
3 unexposed, in the exposure-response analysis from a
4 cohort, to determine what those odds ratios would have
5 been?

6 A Right, because residential -- again,
7 residential exposure is not the only way you get
8 exposed at Camp Lejeune.

9 Q Okay. You have a statement at the bottom of
10 that page that "specificity of the exposure
11 classification would be much lower (e.g., between 0.70
12 and 0.85) because all members of the Camp Lejeune
13 cohort were considered 'exposed' although it is likely
14 that some were not exposed." Do you see that?

15 A I'm trying to see what I'm saying here.

16 Yeah, the specificity would be much lower
17 because all members of the Camp Lejeune cohort were
18 considered exposed, although it is likely that some
19 were not exposed. Yes.

20 Q And what's the basis for that statement?

21 A It's a guess. How many I thought might not
22 be exposed because they didn't get it residentially and
23 they didn't get it in training. Or if they did get
24 exposure from eating at the commissary, it wouldn't be
25 that important, necessarily. If that's the only source

1 of exposure, is going to a restaurant at Camp Lejeune,
2 it may not have any effect at all.

3 Q And then above that, you're talking about
4 sensitivity, and you say "the sensitivity of the
5 exposure classification would be very high
6 (e.g., greater than 0.95) and the false-negative
7 proportion would be very low because very few of those
8 classified as 'unexposed' (i.e., the Camp Pendleton
9 cohort) would have an exposure to these contaminants."
10 Do you see that?

11 A Yes.

12 Q And what's the basis of that statement?

13 A I'm assuming that no one at Camp Pendleton
14 was exposed because the drinking water was not
15 contaminated with these contaminants during this
16 period.

17 Q Did you do any research into whether there
18 was a potential for exposure to these chemicals at
19 Camp Pendleton?

20 A I looked at the health assessment. We have a
21 health assessment of Camp Pendleton.

22 Q That's the ATSDR public health assessment?

23 A Yes, ATSDR public health assessment.

24 Q Do you recall what year that was?

25 A I reference it somewhere.

1 Q Do you recall having a communication with
2 Dr. Sinks in 2007 saying that there were problems with
3 trying to do a comparison between Camp Lejeune and
4 Camp Pendleton Marines because the Pendleton Marines
5 may have been exposed to contaminants at that base?

6 A I don't recall a conversation, no.

7 Q Okay.

8 A That might have been something he said,
9 not --

10 Q Okay, well --

11 A I don't think I said that. That's what I'm
12 trying to --

13 Q That might be correct.

14 A Yeah. There always was some question. I
15 remember not only Sinks, but Dr. Funk and -- also
16 asking that question. And they were also questioning
17 whether there were other exposures that might be
18 important, like when you clean your gun and things of
19 that sort. So we had those discussions back then while
20 we were thinking of how we were going to do these
21 studies.

22 Q Okay.

23 MR. BAIN: Let me just make this the
24 next exhibit.

25 (Exhibit 21 marked for identification.)

1 Q (By Mr. Bain) So, Dr. Bove, I've marked as
2 Exhibit 21 an email between you and Dr. Sinks and
3 others.

4 A Uh-huh.

5 Q It's an email chain from April 2007. And
6 take a minute to look it over.

7 A Okay, I sort of perused it, but in particular
8 what --

9 Q Yes.

10 A What are you focused on here?

11 Q Does this reflect some communication you
12 had back and forth with Dr. Sinks regarding the
13 suitability of doing an analysis of Camp Lejeune
14 versus Camp Marine [sic] populations?

15 A This is a discussion of what kind of study
16 and whether a study made sense at Camp Lejeune, not
17 more than dealing with Camp Pendleton.

18 The question -- what I see from Sinks is,
19 "Before we commit to any cohort analysis, we ought to
20 know if we can reasonably estimate exposure," and so on
21 and so forth.

22 So the issue right off the bat was: Can we
23 do a study at Camp Lejeune? Does it make sense?

24 And as I said, some of the issues raised were
25 not only do we have an unexposed group, can we actually

1 properly assess exposure to the Camp Lejeune Marines,
2 and what about other solvent exposures at work and,
3 again, cleaning your gun and so on and so forth.

4 So at this point -- we were asked in 2005 to
5 do a mortality study, to do a cancer incidence study if
6 it was feasible, and here we are going back and forth
7 as to whether we could actually do one and what it
8 would entail. So that's my understanding of this.
9 That seems to be what's going on here.

10 Q And if you look at the email that you wrote
11 to Dr. Bove [sic] on Monday, April 2nd, 2007, and if
12 you look at the next-to-last paragraph, it starts
13 "At the CAP meeting." Do you see that one?

14 A Uh-huh.

15 Q You mention here, third sentence, "Another
16 approach is to compare the Lejeune Marines to
17 Camp Pendleton Marines, but this may be difficult to
18 do, and the Pendleton Marine may have been exposed to
19 contaminants at that base," right?

20 A Okay, I see that, yeah.

21 Q And --

22 A I'm not sure whether the health -- I had
23 looked at the health assessment at that point or
24 whether it had been published by that point. It
25 probably was either in the pipeline or published by

1 2007, but I'd have to look that up.

2 Q Okay, but --

3 A Again, we were -- I raised -- a number of
4 things have been raised in this memo or whatever,
5 email. A lot of different ideas were thrown around
6 between Dick Clapp's idea of using NIOSH data and so
7 on. So we were at the exploratory point here, so this
8 is a deliberate -- what do you call it, a deliberative
9 discussion, or whatever you want to call it. This --

10 Q You're right, deliberative process.

11 A Yes. We're -- you know, we're throwing
12 around ideas. I had no information indicating -- at
13 this time for sure -- that Pendleton had a problem, you
14 know, because I was raising the possibility that
15 Pendleton would be the comparison group, and that's why
16 we're having that discussion.

17 Q So as far as you can recall, what you did was
18 looked at the public health assessment for
19 Camp Pendleton, and that assured you that there wasn't
20 that problem?

21 A Right.

22 Q Did you look at anything else with respect to
23 Camp Pendleton?

24 A I tried to. I tried to look at water quality
25 statements that might have been online. I searched

1 high and low, but the only information we had was from
2 that PA, that public health assessment.

3 Q Okay. Were there any other issues --

4 A And the public health assessment, now that I
5 remember it, so it must have come out after that,
6 talked about other issues at the base such as -- the
7 same issues that Camp Lejeune had, lead in certain
8 areas because the piping and the kind of -- soft water
9 and so on. There was those issues. There were a few
10 THM issues which also was a problem at Camp Lejeune,
11 and New River in particular.

12 So it's not like the drinking water was
13 totally clean. It just did not have those contaminants
14 in it. There was some of -- a type of radiation that
15 was found in a groundwater sample, not necessarily in a
16 drinking water sample. So during the -- there was also
17 a pesticide that was detected in groundwater sample. I
18 remember that. Again, not found -- not detected in the
19 drinking water itself.

20 So there is a potential, but the PHA
21 basically did not -- basically said that this is it,
22 that was the only contaminants, if they were
23 contaminants, in my understanding -- in my recollection
24 of the PHA.

25 Q Okay. Were there any other issues that you

1 recall comparing the Camp Lejeune population to the
2 Camp Pendleton population?

3 A I mean, people raised the issue, and
4 Marine Corps certainly raised the issue, "Well, that's
5 California." I know some people in my agency thought,
6 "Well, you know, they're New Age out there," and, you
7 know, Camp Lejeune -- in fact, one of the reviewers
8 said, "Well, Camp Lejeune, they probably smoke a lot
9 more because it's North Carolina," not understanding
10 that that -- the people came from everywhere and that
11 everybody smoked.

12 So, you know -- so there were these kinds of
13 things brought up, but there really -- there really was
14 not a better comparison group than Pendleton.

15 Q Okay. Turning briefly back to the civilian
16 study, which is Exhibit No. 4.

17 A Uh-huh. Exhibit 4.

18 Q Go to page 11 of that study.

19 A Okay.

20 Q The last full paragraph, which starts with
21 "Another serious limitation." Do you see that?

22 A Yes.

23 Q You state, "Another serious limitation of the
24 study was exposure misclassification bias."

25 A Uh-huh.

1 Q This is because you assumed that all the
2 Camp Lejeune workers spent considerable time during the
3 workday at the Mainside area of the base --

4 A Right.

5 Q -- served by Hadnot Point even though,
6 undoubtedly, some did not work at Mainside, right?

7 A Yes.

8 Q And additionally, you didn't have information
9 on the workers' water usage, and some may have been
10 unexposed because they didn't use the drinking water?

11 A Yes.

12 Q You also assumed that all the workers resided
13 off base and were not served by contaminated water at
14 their residences, right?

15 A Right. And I subsequently learned that there
16 may have been some teachers that lived on base.

17 Q Okay.

18 A You know, but -- you know, we didn't
19 distinguish teachers from the rest of the workers.

20 Q Okay. Let's turn to the 2017 assessment of
21 evidence, which Ms. Greenwald asked you about,
22 Exhibit No. 5.

23 A Yep.

24 Q You testified, in response to Ms. Greenwald's
25 questions, that you were the sole author of this

1 particular document; is that right?

2 A Yes.

3 Q I notice, though, your name, as far as I can
4 tell, is not listed anywhere on the document.

5 A Yes, that's true.

6 Q Is there any particular reason for that?

7 A I wanted it to be an ATSDR report. I didn't
8 want it identified with me because I felt that if it
9 was -- if my name was the only name on there, they just
10 would say that it's Dr. Bove's opinion --

11 Q Uh-huh.

12 A -- and not take into account that it was
13 peer-reviewed twice, went through agency clearance and
14 so on, in other words, the agency stood behind it. So
15 that's why I felt I didn't need my name on it, make it
16 an ATSDR report. The leadership had no problem with
17 that, agreed with it.

18 Q So there was some discussion at the agency
19 about that?

20 A Not much. I -- you know, I said it makes
21 sense that we do it that way. They agreed. There
22 wasn't a formal discussion. I just -- if I remember
23 right. I just had a good relationship with
24 Dr. Breyse, and we probably just talked it out
25 informally.

1 Q Was there any precedence in the agency for
2 this type of report?

3 A No.

4 Q So this was the first of its kind?

5 A Yes. And, again, I think I went through why
6 we did it. We would not have done it if the VA had not
7 requested assistance.

8 Q Are there any type of reports that you know
9 at ATSDR that do not list who the author is?

10 A I'm trying to think. Does the survey have
11 our names on it, the report online? Any other reports?
12 I'm not sure.

13 Q Okay.

14 A I'd have to say that.

15 Q So you said that you were the sole author,
16 but there were two peer-reviewers, I believe you said,
17 right?

18 A Two different sets of peer review. There
19 were two peer-reviewers in the -- in the initial stage,
20 before I did the briefing, in September of 2015. That
21 was David Kriebel at the University of Lowell and
22 Kyle Steenland at Emory.

23 And then there was a subsequent peer review
24 when the document was written in draft form later in
25 2016, before it was published on our website, and I

1 don't remember who those peer-reviewers were. There
2 were -- there were three, I'm sure, just like we
3 normally do.

4 Q Were those people within ATSDR?

5 A No, no, no. No.

6 Q They're external?

7 A Always.

8 Q Okay.

9 A The peer-review process is always external.

10 Q By the time you got the second peer review,
11 were there any substantive comments in that peer
12 review; do you recall?

13 A I'd have to look.

14 Q Okay.

15 A I'm sure there were some. I don't remember
16 having to change much. There were disagreements. A
17 peer-reviewer comment you disagree with, you -- you can
18 disagree with it and write your reasons, and then the
19 Office of Science decides whether you answered the
20 issue or whether you responded appropriately.

21 So -- but that was -- whatever comments I
22 got, we solved any of them that might have been
23 problematic, or it wouldn't have been released.

24 Q So were the peer-reviewers, Dr. Kriebel and
25 Dr. Steenland, were they both epidemiologists?

1 A Yes, both of them have worked in the field of
2 occupational epidemiology. Kyle Steenland worked at
3 NIOSH before he taught at Emory. David went to
4 Harvard. I was in the same class as him. It's --
5 well, he may have been ahead of me, but we knew each
6 other from school. He has worked on a lot of
7 exposure-response-type modeling, as well as
8 occupational epi studies, and was a co-author of one of
9 the key books in occupational epidemiology.

10 Q Would it be fair to say that there were no
11 toxicologists involved in the assessment of evidence in
12 this report; you were the sole author, but no
13 toxicologists involved in peer review?

14 A No toxicologist was involved in peer review.
15 The tox program made comments, and we went back and
16 forth. There were a lot of disagreements.

17 And, again, the problem here was the
18 toxicologists are not epidemiologists and do not
19 understand epidemiologic studies or the methodology or
20 how to interpret them. They know how to interpret
21 animal studies.

22 And so we had a back-and-forth internally. I
23 don't know if there are any documents that you are able
24 to find with that, but there was an internal
25 discussions about the tox.

1 And some of the -- some of the stuff I did
2 here ended up in tox profile, so it was -- they didn't
3 totally object to what I'm saying in here.

4 And the other thing is, it's a different
5 purpose. The purpose here is to discuss what evidence
6 there -- what diseases might make sense for presumption
7 at Camp Lejeune, and the tox people at ATSDR have a
8 different mandate. They're looking at
9 chemical-specific, not sites, not -- and what the
10 animal data looks like, what the human data looks like,
11 and so on.

12 So we're -- we're not really working in the
13 same ballpark, and so that came -- that was part of the
14 problem. We were talking past each other.

15 But no toxicologist per se was a
16 peer-reviewer. I'm -- but I'm not sure about that
17 because I don't remember who the three peer-reviewers
18 were in the --

19 Q The second peer review?

20 A Yeah, I can't remember who they were. I'd
21 have to -- if you have documents, that might refresh my
22 memory and I could tell you if one of them was a
23 toxicologist.

24 Q Yeah, I don't have any right on the top of
25 my head.

1 A It was -- you should have gotten --

2 Q Uh-huh.

3 A -- that because I identified it in the --
4 among the files.

5 Q Okay.

6 A I'm pretty sure.

7 Q Okay. When you said the tox program was
8 involved in providing some input, that's separate from
9 the peer review?

10 A Totally separate. In fact, they did it on --
11 they decided to do it on their own for some reason. It
12 was not something that Dr. Breysse wanted them to do,
13 let's put it that way.

14 Q Do you recall who that was?

15 A It was -- no, I don't. It was a couple of
16 people in the tox program who worked on it, and I can't
17 remember who they were, but they were -- they've been
18 involved with the tox profiles themselves. So this is
19 something they decided to do on their own.

20 Q Okay.

21 A You know, I listened to it because there is
22 some material in here that's toxicological, that's
23 mechanistic. As I said, for bladder cancer, I
24 evaluated studies that looked at mechanism.

25 And so I was interested in seeing how they

1 felt about those -- that part of the text, because that
2 is something they do know something about. And I can't
3 remember whether they provided useful information on
4 that or not.

5 Q Okay. Were there any oncologists involved in
6 this report at all, either giving you input informally,
7 like the tox program did, or through peer review?

8 A Oncologists? No.

9 Q Okay. Were there any people who held
10 themselves --

11 A But why would an oncologist have any
12 information on the evidence for an exposure -- chemical
13 exposure and a cancer? Oncologists know about cancers.
14 They don't know about exposures unless they're -- also
15 have background in environmental or occupational
16 health.

17 Q Right.

18 A That's part of the problem, okay, with --

19 Q That's a good -- that's a really good point.

20 A Yeah.

21 Q What about people who are experts in these
22 particular chemicals, were there any of those people
23 involved, other than the toxicologist you already
24 mentioned?

25 A I'm not sure who the other three

1 peer-reviewers were. I mean, Kyle Steenland has worked
2 with -- as I say, worked at NIOSH, looked at a lot of
3 different occupational groupings. And I'm sure at
4 least one of them would be workers involved with TCE or
5 PCE or both.

6 So Steenland -- and David Kriebel, he --
7 his -- I think the exposures he's focused on are more
8 respiratory issues, but I'm not positive. I don't have
9 his CV. But David would know. David Kriebel would
10 know about TCE and PCE.

11 And Dick Clapp was around to talk to. He was
12 on the CAP. And Dick Clapp knows about TCE and PCE for
13 sure and also knows about cancer. But he was not a
14 peer-reviewer because he's on a CAP. Right.

15 Q Did the CAP get a copy of this before it was
16 issued?

17 A I think so. Again, I can't remember when we
18 gave it to the CAP. But either -- when we published
19 it, we certainly gave it to them. We may have given
20 them -- I don't remember --

21 Q Okay.

22 A -- I have to say. I have to say. Probably
23 when we released it, we gave it to them, and they also
24 made it available to the Marine Corps. I don't
25 think -- Marine Corps, sometimes we gave them materials

1 a day or two before so they could handle the press on
2 it.

3 Q Uh-huh.

4 A I don't know if they did that for this.

5 Q Other than what has been mentioned with
6 respect to the tox program and the peer-reviewers, were
7 there any other scientists from any other disciplines
8 who became involved in this report?

9 A No.

10 Q Was this submitted to any academic journal
11 for publication?

12 A No.

13 Q Any particular reason why not?

14 A That wasn't the purpose of it. The purpose
15 was, again, to help the VA and their presumption list.
16 And once they put the presumption list, we felt we
17 ought to at least put this out as a report.

18 Q You mentioned the background of this being to
19 assist the VA with respect to their presumption list.

20 A Yes.

21 Q Is that basically true?

22 A Yes.

23 Q What -- how did that affect the standards
24 that you used, if at all, in reviewing the evidence?

25 A It just meant that they gave me six weeks to

1 brief them.

2 Q Okay.

3 A And so it made me have to make quick
4 decisions on classification scheme and to also -- the
5 literature -- gathering the literature together, making
6 the tables and so on. So that's the only impact.

7 Q At one point this morning, I think in
8 response to one of Ms. Greenwald's questions, you
9 mentioned giving the benefit of the doubt to the
10 veteran. I think that's also mentioned here in this
11 report.

12 Did that have an effect on how you reviewed
13 the evidence?

14 A No, that's -- that had an impact on the
15 choice of the classification scheme because they have
16 that position, the VA has that position, and the IOM
17 acknowledged that in determining what kind of
18 classification that made sense for presumption. So I
19 followed that. But that doesn't impact the specific
20 assessments of each of the chemicals and diseases in
21 here.

22 Q It affects the classification scheme?

23 A Scheme, yeah. The classification scheme was
24 adopted because it fit the VA's presumption and the way
25 VA does things.

1 Q Okay.

2 A And, again, I'm briefing the VA on a program
3 they're going to establish, so I want it to be relevant
4 to what they do.

5 Q Okay. If you look at the second paragraph of
6 page 2 --

7 A Okay.

8 Q -- it states, "ATSDR integrated the findings
9 from its Camp Lejeune studies with findings from
10 studies of other populations exposed occupationally or
11 environmentally to the chemicals detected in the
12 drinking water at Camp Lejeune: trichloroethylene
13 (TCE), tetrachloroethylene (also known as
14 perchloroethylene or PCE), vinyl chloride and benzene."

15 A Uh-huh.

16 Q "The purpose was to assess the strength of
17 the evidence supporting causality of adverse health
18 effects from exposures to the drinking water
19 contaminants at Camp Lejeune. This report represents
20 ATSDR's assessment of the state of the evidence at this
21 time." Did I read that correctly?

22 A Yes.

23 Q So is it fair to say that this analysis
24 considered the findings of prior Camp Lejeune studies,
25 as well as epidemiological literature, with respect to

1 the specific diseases and chemicals listed: TCE, PCE,
2 vinyl chloride, and benzene?

3 A Yes, we tried to integrate those findings.
4 Uh-huh.

5 Q And the report includes a table of the
6 epidemiological literature for each disease, followed
7 by a summary of the EPA, NTP, and IARC toxicological
8 reviews and the ATSDR's assessment, right?

9 A Right. For some chemicals and diseases,
10 there wasn't a report. So if there wasn't one, of
11 course, we didn't discuss it. But if there was one by
12 EPA, NTP, or IARC, we discussed it.

13 Q Okay.

14 A Uh-huh.

15 Q On page 7 of the report, there's a section
16 entitled "ATSDR's Methods Used to Assess the Strength
17 of the Evidence for Causation."

18 A Uh-huh.

19 Q Do you see that?

20 A Yep.

21 Q On page 8, if you turn it, and it's in this
22 section, it's the last full paragraph, it says, "In the
23 disease-specific tables, 95 percent confidence
24 intervals were provided in order solely to indicate the
25 level of precision or uncertainty in the effect

1 estimates. An effect estimate (e.g., risk ratio, odds
2 ratio, or standardized mortality ratio) was considered
3 to have good precision (or less uncertainty) if the
4 ratio of the upper limit to lower limit of its 95
5 percent confidence interval was less than or equal to
6 2," right?

7 A Uh-huh.

8 Q Is that yes?

9 A Yes. Sorry.

10 Q That's okay. It's common.

11 So then that's what we talked about before,
12 is the confidence interval ratio, right?

13 A Yes.

14 Q And as you mentioned before, there's no
15 standard in epidemiological [sic], setting it at a
16 particular number?

17 A Or in a statistical setting, no. There --
18 it's a judgment call.

19 Q So --

20 A What you decide.

21 Q So would it be fair to say that using less
22 than or equal to 2 was your judgment call with respect
23 to the precision needed?

24 A Yes.

25 Q And what would you explain as the purpose of

1 using a ratio of less than or equal to 2?

2 A Well, again, it's not -- was not meant to be
3 a dichotomous thing, like a .05 p-value, which is just
4 as arbitrary, by the way, as a confidence interval
5 ratio of less than or equal to 2 or any other value.

6 But I thought that if it has a confidence
7 interval ratio that tight, that's good -- that's
8 darn good precision. Higher than that doesn't mean
9 it's got bad precision. Of course, if you a confidence
10 interval ratio of 4, 5, 6, 10, then we're talking about
11 very little precision. So it's a continuum. It's not
12 yes, no, good precision. It's a continuum.

13 Q So what would be the effect of changing that
14 number to 3?

15 A I don't think it would have much effect at
16 all.

17 Q Okay. If you look to page 30, and I believe
18 this is the table for non-Hodgkin's lymphoma. Can you
19 confirm whether that's correct or not? It goes back to
20 page 23. I think it's the table that starts on page
21 23.

22 A So this table goes on. Okay. Let me
23 double-check. Okay. Yeah, yeah. Okay. Okay.

24 Q Okay. I want to focus on the part of the
25 table that has the Camp Lejeune studies.

1 A Yeah.

2 Q So for NHL, the assessment of the evidence
3 found sufficient evidence of causation, right?

4 A Yes.

5 Q With respect to the specific Camp Lejeune
6 studies, the hazard ratios in both the Marine/Navy
7 mortality study and the civilian workers mortality
8 study were less than 1, right?

9 A Right. This is causes of death, yes.

10 Q Which means that there were fewer NHLs at
11 Camp Lejeune than there were at Camp Pendleton,
12 controlling for other factors?

13 A Right, for causes of -- as a cause of death,
14 yeah.

15 Remember, non-Hodgkin's lymphoma is a
16 survivable cancer. It's a cancer of older ages, and
17 this is a young cohort. So it's included in here
18 because it's done -- it was done, it was analyzed, but
19 the other studies in the occupational field were much
20 stronger on this issue.

21 Q Okay. Let's look at the table for bladder
22 cancer.

23 A Do you know what page?

24 Q The Camp Lejeune study's on page 89. The
25 table, I'm sure, starts before that. The table starts

1 on page 86 --

2 A Uh-huh.

3 Q -- and the Camp Lejeune study's on page 89.

4 A Right.

5 Q Bladder cancer, the assessment of evidence
6 found sufficient evidence of causation, right?

7 A Right.

8 Q The Camp Lejeune studies, both the
9 Marine/Navy mortality study and the civilian worker
10 studies, show the hazard ratio of much less than 1,
11 right?

12 A Right. For civilian workers, it's based on
13 only two cases.

14 Q Okay. But it's based on much larger cases
15 for Marine and Navy?

16 A Eleven.

17 Q Okay. And so what this indicates is that
18 more individuals at Camp Pendleton had bladder cancer
19 or died of bladder cancer than those at Camp Lejeune --

20 A Yes.

21 Q -- controlling for age and other factors?

22 A Right. That's what -- yeah.

23 Q Okay. Let's go to page 3 of the report, and
24 I think Ms. Greenwald asked you about this as well. If
25 you look at the paragraph right before the "Methods"

1 section, it states, "A Marine in training at
2 Camp Lejeune consumes an estimated 6 liters of water
3 per day for three days per week and 3 liters per
4 water [sic] the rest of the day [sic]." Do you see
5 that?

6 A Yeah. No, no --

7 Q "Per day for the rest of the week." I'm
8 sorry. I misstated that.

9 And you cite the ATSDR 2016 for that
10 statement, right?

11 A Yes. It's the public health assessment at
12 Camp Lejeune, yeah.

13 Q Do you recall what the public health
14 assessment relied upon for that statement?

15 A There were at least two -- one document,
16 probably two documents, where the information was
17 mentioned. And I think I found them and gave them to
18 the health assessment, but I don't have -- I don't know
19 if I have referenced it anywhere. They referenced it.
20 So if you've got the health assessment, you can see the
21 references.

22 Q I think you referenced it in --

23 A Did I reference --

24 Q -- your mortality study.

25 A The new one or the old one?

1 Q 2014.

2 A Let's see.

3 Q Wait. Maybe not.

4 A No, I don't think so. I don't think I found
5 it until after that.

6 Q Okay.

7 A I think it came up because the health
8 assessment wanted to have some notion of how to
9 evaluate the exposures that a typical person -- a
10 typical Marine, a typical civilian worker, a typical
11 resident, a dependent would get. And so we scoured
12 around looking for articles that would tell us this.

13 Q Okay. If you look back on page 3, the next
14 sentence says, "Under warm weather conditions, a Marine
15 may consume between 1 and 2 quarts of water per hour
16 and shower twice a day." Do you see that?

17 A Yes.

18 Q And you cite --

19 A Right.

20 Q -- Bove 2014a, which I think is the --

21 A Yeah, it's the Marines study. I'm not sure
22 where I got that from, so I'll have to look, if that's
23 the same document.

24 Q I believe that's Cite 30 in that particular
25 document.

1 A Oh, yeah. Oh, yeah. Okay, so that's --
2 that -- now I remember. That is one of the two I'm
3 talking about.

4 Q Kolka 2003?

5 A Yeah, yeah. Aviation, Space, and
6 Environmental Medicine, yes. Yep. There was another
7 one, I thought, too, but it's not listed here. I may
8 have found that later.

9 Q I'm going to make the Kolka article an
10 exhibit.

11 MR. BAIN: Can you get that?

12 THE WITNESS: Oh, you have it.

13 MR. BAIN: Yeah.

14 THE WITNESS: Okay.

15 (Exhibit 22 marked for identification.)

16 Q (By Mr. Bain) Dr. Bove, I have shown you
17 what's been marked as Exhibit 22. Do you recognize
18 that as an article by Kolka, et al., on "Current U.S.
19 Military Fluid Replacement Guidelines"?

20 A Yes.

21 Q And is this an article that you cited for the
22 statements regarding a Marine's water consumption?

23 A Let's see. So this is one of the two. I
24 think there's another one that -- again, if you went
25 back to the health assessment, you could confirm that

1 there is -- whether there was another one. I seem to
2 remember that there was.

3 Q Okay.

4 A Because I don't see -- this -- the first --
5 the first statement, where it actually breaks it down
6 by -- in the same way I have it here, so -- I'd have to
7 go through this and look it over anyway. But I would
8 again refer you to the health assessment because that's
9 where they reference it and that's -- I wasn't
10 involved other than to help. I was not involved in
11 writing the health assessment.

12 Q But you believe there's another article aside
13 from this one?

14 A I think so. So -- but, again -- because I
15 don't -- it was clear to me in one article that -- and
16 it was clear to the people writing the health
17 assessment that it was 6 liters of water per day for
18 three days and 3 liters for the rest of the week. And
19 it was specific for Marines. Not specific for Marines
20 at Camp Lejeune, but Marines. And I don't see that
21 here. So I think this is the source for the other
22 statement, the 1 to 2 quarters -- 1 to 2 quarts of
23 water per hour.

24 Q Okay.

25 A I think that's where this -- that came from.

1 But where the other statement came from, I think it's
2 another document.

3 Q I'll try to run that down tonight.

4 A Yeah.

5 Q But with respect to this particular study --

6 A Uh-huh.

7 Q -- were you aware that this study was focused
8 on -- I'm going to mispronounce this -- hyponatremia?

9 A No.

10 Q Do you know what hyponatremia is?

11 A My guess is just dehydration, but I do not
12 know for sure.

13 Q My understanding is hyponatremia is having
14 ill effects from drinking too much water. Have you
15 ever heard of that before?

16 A No.

17 Q Okay. Do you know whether the -- and this
18 study appears to be focused on whether or not the
19 guidelines that the Marine Corps had could result in
20 hyponatremia.

21 A Uh-huh.

22 Q Other than that other study you think might
23 exist, are you aware of any studies regarding how much
24 water Marines at Camp Lejeune actually drank during
25 training?

1 A No. But the Marine Corps did review the
2 health assessment. I saw that statement and --

3 Q Okay.

4 A -- had no problem with it, as far as I know.

5 Q And ATSDR independently never investigated
6 Marines' actual water consumption habits at
7 Camp Lejeune?

8 A I think we -- in the survey, we might have
9 asked. But the problem was you're asking them now what
10 they drank 20 years ago, and you never get good
11 information doing that.

12 So I -- if we did ask in the survey, the
13 health survey, the big one, whether -- how much they
14 drank, I don't think the information would have been
15 useful anyway, so we may not have asked. So I --

16 Q Would information about how much water
17 Marines currently drink in training have any value to
18 you in determining -- making determinations on this?

19 A It might. Again, I wasn't -- the purpose --
20 it depends on what your purpose is. For the purposes
21 of the public health assessment and trying to figure
22 out what the typical person might have been exposed to
23 and what the health effects might be, yes. For the
24 epidemiologic studies, no.

25 Q Why not? Why the distinction?

1 A Just not as useful. I mean, you won't know
2 whether -- what individual drank how much, even with
3 that information. It's only good for the typical
4 person. Okay.

5 Q And you believe -- because I didn't see
6 anything in the Kolka article about the showering
7 habits of Marines. You believe that might be in the
8 other document that's referenced?

9 A I believe that that -- but I'm not -- I don't
10 know for sure, so I want to be honest. But I think
11 there were two documents. I seem to remember two
12 documents. But, again, you can check the health
13 assessment. It should be referenced there. And if
14 it's not -- if it's not clear there, you need to talk
15 to someone who worked on that health assessment --

16 Q Okay.

17 A -- if you can still find them.

18 Q If there is another document, it either
19 should be referenced in the health assessment or the
20 person who did that assessment should know what the
21 statement is based on?

22 A Yeah, but I think it has -- they really
23 should reference it. If they didn't, they were
24 neglect -- negligent, but they should have.

25 Q Negligence, that's a word we've got to watch

1 out for.

2 A I'm sorry. I don't want to use that term
3 either. They should have made the references known,
4 yeah.

5 Q Okay. At the end of that paragraph, you say,
6 "It is likely that during training, the water supplied
7 in the field came from the Hadnot Point water system
8 with both measured and estimated levels of TCE and PCE
9 substantially higher than their MCLs," right?

10 A Uh-huh. Yes.

11 Q And what's the basis of that statement?

12 A Again, discussions with the Marine Corps
13 where water was -- where the water for training came
14 from and -- and the water buffaloes. That's my memory
15 of it. There may have -- I don't remember a document
16 saying it specifically, but there may have.

17 Again, you may want to check the public
18 health assessment to see if they discuss it and if they
19 have a reference.

20 Q Are you aware of whether ATSDR did any
21 investigation of where the water fill points were at
22 Camp Lejeune?

23 A Where the?

24 Q The places --

25 A Where the -- no, no, we did -- we did not.

1 Q So ATSDR would be not have been familiar
2 whether there were water fill points for the water
3 buffaloes on both the western and eastern side of
4 New River?

5 A I wouldn't know that, no.

6 Q Are you aware of where the training areas
7 were on the eastern and western sides of New River?

8 A No.

9 Q Do you know how many miles the training areas
10 on the western side of New River are from Hadnot Point?

11 A No idea.

12 Q Do you have any basis to state as a fact that
13 the water buffaloes were filled at Hadnot Point for
14 training exercises on the western side of New River?

15 A Was that said here in this sentence? What we
16 said here is that if you were -- well, what was implied
17 here, I think, is that if you were training on
18 Mainside, where a lot of the training occurred, your
19 water buffalo would have been coming from Hadnot Point.
20 If you were training at New River, obviously the water
21 might -- it would come closer to where that training
22 is. But that's not what we're saying here.

23 What we're saying here is that much of the
24 training, if not most of the training, was in the
25 Hadnot Point or Mainside vicinity and that the water

1 would come from there.

2 Q Okay. Yeah, I understand that now, and that
3 helps clarify this sentence because it just refers to
4 training generally, not training --

5 A Yeah, we should have made that clear, I
6 agree. Okay.

7 Q I think you answered this this morning, but
8 why does the report compare levels of TCE and PCE to
9 the MCL?

10 A Just as a reference. This is the background
11 section of this assessment. Just, if people see -- we
12 did this for the studies too -- if people see 1400
13 parts per billion, what does that mean? If they see
14 benzene at 12 parts per billion, what does that mean?
15 I mean, they -- you know, people aren't -- who are not
16 drinking water experts might have a problem
17 understanding what that might mean.

18 Let's -- I know that the Marine Corps doesn't
19 like it when we mention MCLs because they keep saying
20 that they weren't in place when the drinking water was
21 contaminated. This is a true statement, they weren't,
22 but that's not the point I'm mentioning. The point is,
23 again, to give people a sense of what -- how high
24 this -- how high this contamination really was.

25 MR. BAIN: Do you want to take a break?

1 THE WITNESS: No, let's --

2 THE COURT REPORTER: I would like to
3 take a break.

4 MR. BAIN: Okay.

5 THE VIDEOGRAPHER: The time is 4:12 p.m.
6 Going off the video record.

7 (Recess taken.)

8 THE VIDEOGRAPHER: We are back on the
9 record. The time is 4:23 p.m.

10 Q (By Mr. Bain) Okay, Dr. Bove, I want to keep
11 talking a little bit about the assessment of the
12 evidence --

13 A Uh-huh.

14 Q -- which is Exhibit No. 5. If you turn to
15 page 5 and the last paragraph of page 5, it says,
16 "The classification scheme adopted for this report is
17 the one recommended by an IOM panel that reviewed the
18 VA's presumptive disability decision-making process for
19 veterans," and you cite IOM 2008. Do you see that?

20 A Yes.

21 Q And we talked a little bit about that
22 earlier -- or you did with plaintiffs' counsel.

23 Are you aware whether or not the IOM
24 ultimately adopted this recommendation for the
25 classification scheme?

1 A It was not for their purposes. I think the
2 report, if I recall, is for the VA's purposes, the idea
3 that -- but in many instances, the VA then turns to IOM
4 and asks them to do an assessment, like Gulf War or --
5 so on and so forth.

6 So -- but my understanding is that this -- if
7 the VA was going to have a presumption program and
8 wanted to assess, they should use this
9 classification -- or at least they were recommending
10 that classification scheme.

11 Q Do you know whether the VA ultimately ever
12 used that particular classification scheme?

13 A I don't -- that's a question for the VA
14 because they claim that they did their -- they looked
15 at this, but they have their own assessment. I've
16 never seen their -- a real assessment from them. I saw
17 some brief tables that a toxicologist put together, and
18 I don't know if that went anywhere. So I don't know if
19 they used this or not.

20 Q You're aware that the NRC, in their report on
21 Camp Lejeune, used a different classification scheme?

22 A Yes. Yes.

23 Q How would you characterize the difference
24 between the classification scheme that the NRC used and
25 the one that you used?

1 A Well, the one that they used is more in line
2 with -- I think with the Agent Orange, which is
3 sufficient evidence, I think it was, then there was
4 statistical association, and then there was limited,
5 and then non -- or whatever the heck it was below that.
6 So it doesn't quite fit with -- I mean, sufficient
7 evidence would be the same.

8 Q Uh-huh.

9 A The equipoise and above could be a
10 combination of some of the limited and some of the
11 statistical. So it doesn't fit exactly. It's a
12 different -- it's a different classification scheme
13 because of -- the focus was of the VA, and the NRC was
14 using just a classification scheme that they had used
15 for Agent Orange. IOM, but, you know, the same entity,
16 National Academy, so...

17 Q So would you say that this classification
18 scheme that you used was more lenient in any way than
19 the classification scheme that the NRC used?

20 A No. In fact -- no, no. It's different. It
21 mirrors the fact that the VA has this policy. So if
22 the VA has this policy of giving the veteran the
23 benefit of the doubt, then you want to tailor a
24 classification scheme to their -- the way they -- their
25 policy. So that's -- that's my understanding, again,

1 of why IOM recommended this classification scheme.

2 Q And how does this classification scheme, in
3 your view, give the veteran the benefit of the doubt?

4 A Well, having an equipoise and above does
5 that. And I think that's what the IOM thought.

6 Q Okay. The next sentence of the report says,
7 "This scheme makes clear when the evidence for
8 causality is 'at least as likely as not' or at the
9 level of 'equipoise and above.'" Do you see that?

10 A Yeah.

11 Q What do you mean by that?

12 A Just that -- I'm not sure what I mean by
13 that, I have to say. Just -- it's basically a
14 restatement of what the classification is, there's --
15 that there is a classification level called "equipoise
16 and above," which means "at least as likely as not." I
17 mean, I don't know that there's anything more that that
18 sentence is saying.

19 Q Are you trying to contrast it to the one that
20 the NRC used?

21 A No, no, no. I think it's just trying to
22 define what that level is. It's at least as likely as
23 not, and we're calling it equipoise and above. I think
24 that's what the sentence is all about.

25 Q What methodology did you use to weigh the

1 evidence to determine which category applied to the
2 relationship between the chemical and the disease?

3 A Okay, that -- some of that is mentioned on
4 page 6 and some on page 7. So for sufficient evidence,
5 I had a couple of rules there, one -- two rules in
6 particular. There is sufficient evidence from human
7 studies in which chance and bias, mostly bias, can be
8 ruled out, because that really is the main reason, the
9 main issue.

10 And the second one is that there's less than
11 sufficient evidence from human studies, but evidence
12 from other sources, animal studies, mechanism,
13 whatever, that is relevant to humans.

14 So -- and then I give some of Hill's
15 viewpoints under that that I use in assessing a study's
16 quality and what -- and assessing the evidence that a
17 study can provide.

18 And then the next level was equipoise and
19 above, which that previous sentence we talked about is
20 describing. And there, there's less information than
21 sufficient evidence. There's -- there may be only one
22 high-quality study, but a meta-analysis may be
23 inconclusive, you know, so -- but there is at least one
24 high-quality study that pushes it above the next level,
25 which is there's not enough information here to make a

1 determination almost, and that's below equipoise.

2 Q And how did the odds ratios and confidence
3 interval ratios in particular studies factor into this
4 classification scheme?

5 A Right. The point estimate, the odds ratio,
6 the SMR, the relative risk --

7 Q Uh-huh.

8 A -- the hazard ratio, depending on the study,
9 what they used, is the key element, key -- that's the
10 key, along with, of course, temporal, but we all
11 assumed that there was a temporal relationship with
12 these studies that are included in here. So the rest
13 of Hill's criteria are how -- what's the magnitude of
14 that point estimate.

15 And the next thing is what the
16 exposure-response relationship looks like, if there is
17 one, if they did that. And then whatever other
18 information makes it biologically plausible, including
19 animal data and mechanistic data and so on.

20 If the studies are pretty consistent, you see
21 something that's somewhat the same kind of effect, not
22 the exact same point estimate, but in the ballpark
23 across studies, that's helpful.

24 If you understand why there are differences,
25 because the exposures might have been less at one plant

1 than at another, one study than another study, or
2 something of that sort, that's another thing to take
3 into account.

4 So that's what -- that's how the assessment
5 is done. And, again, some of the work was done already
6 for me by the meta-analysis done by NCI, by EPA, by
7 IARC, and so on.

8 Q Okay.

9 A Yeah.

10 Q So for the third factor in the Hill criteria,
11 the magnitude of the effect, you're looking at the
12 point estimate, which could be the risk ratio, the odds
13 ratio, the SMR. And is that where you integrate the
14 1.2, and looking at a confidence interval ratio of less
15 than or equal to 2, and to the analysis? Is that where
16 that comes in?

17 A The -- I think that the confidence interval
18 ratio really doesn't come into the assessment unless
19 the -- there is such a wide confidence interval that
20 you can't really have any confidence -- I hate to use
21 that term -- that there's so much uncertainty in the
22 point estimate.

23 The magnitude of the odds ratio absolutely
24 does impact the assessment. Whether it's 1.2 or higher
25 is not necessarily -- again, there's no cutoff.

1 Everything is a continuous measure and a judgment call
2 throughout, you know, and so -- so that's how the
3 assessment was done.

4 Relies on work that others have done, as I
5 said, if they've summarized -- you know, if EPA has
6 summarized the evidence themselves and I think it's a
7 good summary, then I go with that because -- unless
8 there's additional studies that even provide more
9 support or whatever.

10 Q So would it be fair to say there's no
11 particular algorithm, but a lot of it is just dependent
12 on your judgment as an experienced epidemiologist?

13 A Yes. There's no specific algorithm. It uses
14 whatever information we have on that chemical and that
15 disease. At the time, up to 2016, middle of 2016.

16 Q Okay. You were asked about this a little bit
17 by plaintiffs' counsel, but she stayed on pages 8 and
18 9, when you're talking about the Hill criteria or Hill
19 viewpoints, as you refer to them, that the assessment
20 of the evidence considered some of the viewpoints
21 associated with Hill.

22 A What page are you on?

23 Q Pages 8 and 9, bottom of 8 and over to the
24 top of 9.

25 A Oh, bottom of 8. Okay. Some of the -- okay,

1 here it is. Uh-huh.

2 Q And these are also referred to sometimes as
3 the Bradford Hill criteria, right?

4 A People do call it a criteria. He did not.

5 Q How do you -- how do you distinguish
6 "criteria" from "viewpoints"?

7 A "Criteria" has a stronger connotation to it.
8 What he is suggesting here is these are things to think
9 about when you're trying to make a case for causality,
10 so if you think about it that way. These are -- you
11 know, may want to touch on the size of the
12 relationship.

13 Now, of course, as I said, you can't have a
14 relationship at all if it's not temporal. If the
15 exposure happened after the cause, you know, it's --
16 but the other ones are points that you may want to
17 raise in making a case.

18 That's pretty much how he's -- if you read
19 the original article, that's where he's coming from.
20 He doesn't use the word "criteria" and doesn't want
21 to -- doesn't want these to sound like hard-and-fast --
22 or an algorithm or anything of the sort. So I take the
23 same position on it.

24 These are -- these are qualities or issues or
25 whatever you want to call them, viewpoints, that should

1 be looked at when you're assessing the evidence.

2 Q And one of them that was discussed earlier,
3 that is not even here considered a viewpoint, was
4 specificity. And you mentioned earlier in your
5 testimony that you didn't consider this to be
6 particularly relevant to environmental exposures, that
7 it was more applicable to infections. Is that --

8 A I'm not the only one who thinks that.

9 Q Okay.

10 A Right. But yes.

11 Q But that's what you said, right?

12 A Yes. And I agree with those who say that,
13 yes.

14 Q And when you say you're not the only one who
15 says that, is there any particular reference that you
16 can point me to that says you shouldn't apply this to
17 environmental exposures?

18 A I'm not sure. If you look at Modern
19 Epidemiology, they discuss Hill's criteria. Actually,
20 they -- okay, I used that term. Hill's viewpoints.
21 They are pretty negative about using Hill's viewpoints,
22 actually, at all, if I remember right, but they may
23 have a discussion there. There may have been a
24 discussion in Savitz's book. It's just general
25 knowledge that there are certain viewpoints that make

1 sense to use and others that don't in any particular
2 situation.

3 In occupational and environmental health, we
4 never use specificity because it's not -- there's no
5 exposure we can think of that it only causes one
6 disease. Even asbestos. It causes mesothelioma, yes,
7 but it also causes lung cancer and other -- and
8 possibly gastrointestinal cancer, you know.

9 Certainly the chemicals we're talking about
10 here could cause a multitude of different cancers, so
11 why -- specificity doesn't make any sense to use.

12 Q Okay. Well, if I state the principle this
13 way -- I'm going to ask you whether you agree with it
14 or not.

15 A Okay.

16 Q "When an exposure is associated with only one
17 or a small number of health outcomes, it is more likely
18 to be causal than when it is associated with many
19 health outcomes. The reasoning is that finding an
20 inordinate number of conditions that are associated
21 with exposure suggests some form of bias."

22 Do you agree with that statement?

23 A No, because I -- yes and no. There -- if --
24 what is an inordinate amount? I mean, I would have to
25 unpack that definition. What is -- this is my

1 philosophy training here -- what's the inordinate
2 amount?

3 Certainly, a chemical like TCE could because
4 kidney cancer, non-Hodgkin's lymphoma, Parkinson's
5 disease, and so on. Is that -- you're going to rule it
6 out then because it shouldn't have so many endpoints?
7 I mean, smoking --

8 Q Uh-huh.

9 A -- we're going to rule that out because it
10 has all these different endpoints. Does that mean
11 there's bias? So that's what I'm trying to say. It's
12 not a useful viewpoint, and I'm sure Hill would say the
13 same for this -- for these -- for this context.

14 In infectious disease, it makes a lot of
15 sense, and he's writing these viewpoints with the idea
16 of both infectious and non-infectious disease. And so
17 he lists viewpoints that you can consider. Again, he's
18 not saying this is a checklist, okay --

19 Q Uh-huh.

20 A -- he's not saying you have to use all of
21 them or most of them. These are just suggestions on
22 how to address the issue of causality, the evidence for
23 causality. So I wouldn't agree with it.

24 Q You wouldn't agree with that statement?

25 A No, not entirely, because I think there are

1 many cases where that wouldn't fit.

2 Q With respect to biological grading or
3 dose-response --

4 A Uh-huh.

5 Q -- you include a parenthetical -- and I'm
6 looking at the top of page 9, and this is No. 4,
7 "exposure-response relationship." You say "although
8 the relationship could be non-linear or non-monotonic."
9 Do you see that?

10 A Yes.

11 Q And is that included in Hill's discussion of
12 that relationship?

13 A I'm not sure it is or it isn't. I'd have to
14 go back and look at Hill. Again, I -- he doesn't have
15 a hard-and-fast rule about what a gradient would look
16 like. That, I seem to remember. But I'd have to go
17 back to the article to see it. But that goes back to
18 our earlier discussion that if you have additional
19 information as to why it's non-monotonic or you had
20 some information as to -- well, if you have information
21 on why it's non-monotonic and it refers to evidence
22 that would support it, then -- so...

23 Q Okay. Let's turn back to page 5. And at the
24 bottom of that paragraph, you -- in the last sentence,
25 you say -- this is in reference to the classification

1 scheme that you're using -- "Additionally, the scheme
2 is one that is already in use by the U.S. Department of
3 Veterans Affairs (VA) in its decision-making concerning
4 compensation for service-related disability
5 compensation claims. The issue of compensation has
6 been of major concern for the Camp Lejeune community."
7 Do you see that?

8 A Yeah, so I wasn't -- maybe I misspoke when I
9 said they haven't used it. Maybe they have used it on
10 certain of the presumption -- for example, for -- I'm
11 trying to think. They do have one for Agent Orange,
12 but they -- how they decided on that, I think it was
13 based on the IOM's classification.

14 So I'm not aware -- I guess I'm confused
15 here. I'm not sure where the Department of -- where
16 the VA used this classification scheme --

17 Q Okay.

18 A -- and whether they have. That's a question
19 for the VA, I guess.

20 Q What I want to focus on is the sentence, "The
21 issue of compensation has been of major concern for the
22 Camp Lejeune community."

23 A Yes, it was.

24 Q And why did you consider that to be something
25 that should be included here in this evaluation of

1 scientific evidence?

2 A It could have been in the background instead,
3 more appropriate in the background section.

4 Q But why would that be relevant at all to
5 include in a report like this?

6 A I think that it's important to state what the
7 community -- the affected community, what their
8 concerns were in a study or a report, if you can, if it
9 makes sense to do that. I think this sentence probably
10 is in the wrong place, but I don't see why it wouldn't
11 be in the background section.

12 Q Okay, so --

13 A I agree with you, it's not a scientific
14 statement --

15 Q Okay.

16 A -- or have anything to do with the evaluation
17 of the assessment of the individual chemicals and
18 diseases.

19 Q So you're saying it might be misplaced in the
20 "Classification of Evidence" section?

21 A Yeah, yeah, probably was.

22 Q Okay. If you turn to page 13, this is a
23 chart you referred to earlier, which is, I think, the
24 overall summary --

25 A Yes.

1 Q -- of the evidence.

2 A Yes.

3 Q The diseases that you classified as
4 sufficient evidence of causation for at least one of
5 the chemicals are kidney cancer for TCE, NHL for TCE
6 and benzene, leukemia for benzene, liver cancer for
7 vinyl chloride, bladder cancer for PCE, and cardiac
8 defects for TCE, correct?

9 A Yes. I don't think I see any other ones.
10 The other ones were equipoise and above, yeah.

11 Q Yeah. So the other diseases you classified
12 as equipoise and above evidence for causation for at
13 least one of the chemicals are NHL with PCE; multiple
14 myeloma were TCE and benzene; leukemia is TCE; liver
15 cancer, TCE; Parkinson's disease, TCE; kidney disease,
16 TCE and PCE; and systemic sclerosis/scleroderma, TCE?

17 A Yeah.

18 Q Correct?

19 A Yeah.

20 Q For the other diseases you looked at, which
21 were pancreatic cancer, prostate cancer, breast cancer,
22 esophageal cancer, rectal cancer, and brain cancer, the
23 evidence was all right below equipoise?

24 A Right, uh-huh, as of 2016. And, again, some
25 of this might have changed with the recent literature,

1 if this was updated.

2 Q This was -- this study was done in 2017, and
3 you included some other prior reviews that had been
4 done by EPA and IARC and NTP, is that right, or NCP?

5 A Okay, it was -- most of the work was done
6 between July or August of 2015 and January -- well, by
7 January 2017, the work had been finished and
8 peer-reviewed and everything else. So most of the work
9 was done between, say, July or August of 2015 and mid
10 2016.

11 It's not a study. That's second thing. It's
12 an assessment, similar to a systematic review, though
13 systematic reviews can have an algorithm or some other
14 method, so we don't call it a systematic review.

15 Q Okay, so it was an assessment. Most of the
16 work was done in 2016?

17 A And late 2015.

18 Q Late 2015.

19 A Yeah.

20 Q And it included, I think as we discussed
21 earlier, a review of the systematic reviews that had
22 been -- or inclusion of the systematic reviews that had
23 been done by EPA, IARC --

24 A NTP, National Toxicology Program, yeah.

25 Q And then you also did PubMed research of --

1 A Yeah.

2 Q -- any epidemiological studies that might
3 have been done?

4 A Right.

5 Q But I notice, by its absence, was the
6 National Academy of Sciences' 2009 report, which was a
7 review of evidence, some of the same relationships
8 between these diseases and these chemicals. Any
9 particular reason why that was not mentioned at all?

10 A Yes. I thought that their review was
11 inadequate, to be nice. Seriously, for them to say
12 that there was limited evidence for kidney cancer at a
13 time when it was obvious that there was sufficient
14 evidence or very close to being it, the fact that no
15 disease made it beyond -- made it above limited, but we
16 know that benzene causes acute myeloid leukemia, where
17 we know that many of these things I'm saying as above
18 equipoise or equipoise and above should at least have
19 been in the statistical association. So, to me, that
20 report is useless.

21 Q So you disagree with the judgments made by
22 the scientists?

23 A I think it's useless, yeah.

24 Q Okay.

25 A Yeah.

1 Q So for that reason, you didn't -- you didn't
2 mention it at all?

3 A Right, because the other -- the other
4 documents, the documents from EPA, NTP, IARC, were far
5 and away better and later, too, than theirs. And I
6 just felt that those were the reliable sources. They
7 are the ones mandated to look at these chemicals and
8 make an assessment. NRC responds to questions provided
9 to them by the entity that pays them. That's a
10 different situation. Okay?

11 So if we're talking about EPA, they have a
12 mandate to do this kind of analysis, so does IARC, so
13 does NTP, so that's why I rely on them. NRC does great
14 meta-analyses. I rely on that. They have -- their
15 mandate is to do good research.

16 NRC, in this case, was to respond to the
17 kinds of questions that they were paid to look at. And
18 that's different.

19 Q Have you ever referred to or relied upon
20 studies done by the National Academy of Sciences?

21 A I've written -- I've been a part of three
22 books with the NRC -- the National Academy of Sciences,
23 I should say.

24 Q But at NRC?

25 A Well, I guess it was the NRC at that point.

1 It was back in -- I can look at my resume, whether I
2 put NAS or NRC. But we were asked -- in that
3 situation, we were asked by EPA to come up with a new
4 method of evaluating emerging threats to drinking water
5 and how would you do that, what kind of algorithm you
6 would develop. So that was our mandate, and that's
7 what we did in those books. Whether EPA did anything
8 with that is another story, but that was the mandate
9 for that.

10 The mandate -- I'm not sure what the exact
11 questions were that the Navy gave to the NRC for that
12 NRC report, but it certainly wasn't to do a thorough
13 assessment, because they did not do it, of the diseases
14 and the chemicals, so...

15 Q Wasn't the mandate actually from Congress but
16 the study was funded by the Navy?

17 A No, my understanding is that the Navy
18 provided the questions.

19 Q That's your understanding. Okay.

20 A That's my understanding. That's what I was
21 told, so...

22 Q You referred to one authoritative treatise
23 today, which was second edition of Interpreting
24 Epidemiological Data [sic] , right?

25 A Savitz's focus --

1 Q He's the author of that book, right,
2 David Savitz?

3 A Yes, he is.

4 Q And you're aware that he was a chairman of
5 the NRC committee?

6 A Certainly was, yes. Yes. Just because I
7 like his book does not mean I like everything he does.
8 I do think it's a useful book, and I have -- you know,
9 again, Modern Epidemiology is extremely difficult to
10 slog through. And as I said, it is the key book for
11 epidemiology, but it's difficult. And Savitz's book is
12 written in a way that most epidemiologists could follow
13 in terms of at least interpreting -- how to interpret
14 studies.

15 Q Okay.

16 A So...

17 Q That's helpful. Okay, I'm done with this for
18 now, and I'm going to start -- we're making headway. I
19 want to turn to the 2018 morbidity study. I don't
20 think --

21 MS. GREENWALD: I didn't mark it.

22 MR. BAIN: You didn't mark that one?

23 (Exhibit 23 marked for identification.)

24 Q (By Mr. Bain) I'm showing what's been marked
25 as Exhibit 23. Can you identify this as the "Morbidity

1 Study of Former Marines, Employees, and Dependants
2 Potentially Exposed to Contaminated Drinking Water at
3 U.S. Marine Corps Base Camp Lejeune"?

4 A Yes.

5 Q And were you involved in this study?

6 A Yes.

7 Q What was your role?

8 A To help with the -- well, let's start with
9 the protocol, which I would say was co-written with
10 Perri Ruckart -- I don't think I wrote it entirely by
11 myself -- and was involved in the -- in the data
12 management, like I've done with all the studies.
13 I didn't mention that, but I've been involved with the
14 data management for all the studies, and some of the
15 analyses. And I'm also -- you know, gave advice to
16 Perri on her analysis of this.

17 Q Other than you and Dr. Ruckart, was anyone
18 else involved in the study?

19 A The contractor. I forget which contractor.
20 And I don't know if they mention it in here.

21 Q Yeah, I didn't see any names listed on this
22 study either of contractors.

23 A Yeah. Okay. Yeah. I don't mention the
24 contractor --

25 Q You just don't recall who it was?

1 A Right. We had -- I'm also blanking on -- we
2 had RTI at one point for some studies. We had
3 another -- I forget the one in the D.C. area. I'm
4 blanking on it. Sorry.

5 Q Okay. Was this study ever submitted to any
6 peer-reviewed journals?

7 A No.

8 Q Why not?

9 A Because the participation rate was so low.
10 And also, we really couldn't verify the outcomes, so --
11 we tried. Some people sent in their medical records,
12 but there was extreme limitations.

13 It was mandated by Congress that a survey be
14 done. We were supposed to just supply the
15 questionnaire, and the Navy/Marine Corps was supposed
16 to actually do the survey, if I remember, legislation,
17 but we decided that we would take it on. I don't think
18 the Marine Corps wanted to take it on.

19 And we thought we might be able to use this
20 as a way of getting at cancer and other diseases that
21 we couldn't get in the mortality study, but we -- but
22 it didn't turn out that way. And so we didn't send it
23 to a journal because we thought it was a very limited
24 study.

25 Q Did the study undergo any peer review at all?

1 A Nothing gets done without a peer review.

2 Q Okay.

3 A No, it was peer-reviewed.

4 Q And can you describe what the peer-review
5 process was for this study, if you recall?

6 A It's the same. They use outside
7 peer-reviewers that either we recommend to the
8 Office of Science and/or they add to it or they decide
9 who it is.

10 Q And --

11 A Also, in this -- in this -- now things are
12 coming back. We did have a panel to look over the
13 protocol for this study, as well, because we are not
14 experts in survey research. We wanted to bring in some
15 people who were, and so we did. And, again, my
16 recollection is good. Both Perri and I worked on the
17 protocol, and it went -- we presented it to this panel
18 as well, so -- but be that as it may, still the results
19 of the study were that we had a low participation rate,
20 and we didn't really feel that we could make a lot out
21 of this, unfortunately.

22 Q The study included both a cohort study and a
23 nested case-control study, right?

24 A Right.

25 Q And I understand the cohort study which

1 compared Camp Lejeune to Camp Pendleton. What was the
2 nested case-control study?

3 A Do you know what page we're -- because that
4 might help my memory.

5 Q No, I don't know. I don't know.

6 A Okay. This is, again, trying to use the
7 residential exposures.

8 Q So that would refer to exposure-response
9 analysis?

10 A Huh?

11 Q Would that refer, then, to some type of an
12 exposure-response analysis?

13 A Yeah. Yeah, I mean -- yeah. So let me look
14 this over because my memory is not good for this study.

15 Yeah. Okay. So two different types of
16 samples were taken here. And a case -- case control is
17 really a sampling method.

18 So the first one, we were interested in, say,
19 kidney cancer, for lack of a better -- okay, so we get
20 all the kidney cancers. And the first analysis
21 includes Pendleton, so we get all the kidney cancers
22 regardless of which base --

23 Q Uh-huh.

24 A -- okay, and then we take a random sample of
25 the people without that disease from -- a random sample

1 which includes people from both bases.

2 Q Uh-huh.

3 A And that's the first analysis. And then
4 there's the internal analysis, which we would then --
5 instead of having Pendleton in the sample at all, it's
6 all just Camp Lejeune, and the idea there would be
7 your -- the reference group would be those people who
8 had no exposure -- or no residential exposure, I should
9 say, as the reference group, just -- okay? So that's
10 how we did that.

11 Q I see.

12 A And we did that in order to see if we could
13 get better information, we could use the family housing
14 records and their survey information to try to get at
15 where they were on base.

16 One of the things about -- I didn't mention
17 before about -- the family housing records, trying to
18 match them with the DMDC data, just for your knowledge,
19 is difficult because the family housing records has
20 their name -- sometimes they have a middle initial for
21 middle name, sometimes they don't have that middle
22 name -- and rank, and then the place where they lived
23 and the dates. Okay? Trying to match that with the
24 DMDC data, when there's so many common names, was very
25 difficult.

1 Q Uh-huh.

2 A We tried to do it. We had a contractor do
3 it. I tried to do it. I'm sure that a lot of the
4 matches were not correct because of that problem of
5 trying to go from one to the other. But you would have
6 to do that to do a good job of using that -- you would
7 have to link the two.

8 Q Right.

9 A And so I think what we're thinking about here
10 is we -- if we had a smaller group of people, we could
11 more intensely see if -- but we'd still have this
12 problem. We still had this problem, yes. So that's --
13 so you understand what --

14 Q Yeah.

15 A -- [indiscernible] case control --

16 Q Got it. Got it.

17 A Okay.

18 Q Thanks. That's helpful.

19 A Yeah.

20 Q I didn't understand that before.

21 So it appears that you sent out or someone
22 sent out about 250,000 surveys --

23 A Right, our contractor, yeah.

24 Q -- contractor did -- for those who were
25 present at either Camp Lejeune or Camp Pendleton in the

1 mid 1970s through mid 1980s, right?

2 A Yeah.

3 Q If you look at page 65 of the report,
4 Table 1, for the Camp Lejeune Marines, you've got about
5 a 25 percent completion rate, right?

6 A Something like that. Let me see.

7 Q In the first column, 25.2 percent.

8 A Yeah. Completed a survey, yeah.

9 Q And for Camp Pendleton, you got 23.3 percent?

10 A Yeah.

11 Q And --

12 A Yes. Yes.

13 Q That's true? Okay.

14 You also asked the participants to complete a
15 HIPAA form so you could confirm the reported diseases;
16 is that right?

17 A Yes.

18 Q And there was a larger percentage of
19 Camp Lejeune survey respondents who complied with that,
20 completing the HIPAA form, than the Camp Pendleton
21 respondents, right?

22 A Yes.

23 Q And for about 50 percent of Marines and
24 40 percent of civilians, you could not confirm the
25 diagnosis because a HIPAA form was not completed; is

1 that true?

2 A Where are we?

3 Q That's on page 55.

4 A Okay. Fifty-five or sixty-five?

5 Q Fifty-five, I think. Yeah, look at 55,
6 middle of the page. You see where it says --

7 A Yeah, yeah, yeah. So that's another
8 limitation. As I was saying, we didn't -- we couldn't
9 confirm a lot of the reports --

10 Q Okay.

11 A -- reported diseases.

12 Q And I think you mentioned before and you're
13 familiar with the term "epidemiologist selection bias"?

14 A Yes.

15 Q And it was a significant limitation for this
16 study, would you agree?

17 A Yes.

18 Q And that would be because people at
19 Camp Lejeune with health problems would have been more
20 likely to return a survey due to publicity surrounding
21 the Camp Lejeune contamination?

22 A Sure, yes. And on the other side of the
23 coin, Pendleton wouldn't participate because they, you
24 know, either don't have a health problem or don't care,
25 this is a Camp Lejeune issue. Yeah. Yeah.

1 Q And that bias would have overestimated any
2 effects resulting in higher odd ratios when comparing
3 Camp Lejeune to Camp Pendleton?

4 A Most likely, yes. Yeah. So you had the
5 selection bias problem, but you also had exposure
6 misclassification problem. They could have crossed
7 each other to some extent. We don't know the magnitude
8 of either one in this study.

9 Q And like the other cohort studies that we
10 looked at from 2014, this one assumed that all the
11 study participants at Camp Lejeune were exposed, in
12 comparison to Camp Pendleton?

13 A Yes.

14 Q And this -- again, as you mentioned in the
15 other studies, this likely would have included people
16 in the Camp Lejeune cohort who had little or no
17 exposure to contaminated water?

18 A Yes.

19 Q And as in the earlier studies, you used the
20 water modeling to assign exposure values for the study
21 participants in the Camp Lejeune cohort?

22 A Yes.

23 Q Did you follow the same criteria for
24 determining exposure as you used in the 2014 study, do
25 you recall, or did you have --

1 A Yeah, I think so.

2 Q Okay.

3 A Again, if we know their residence and we
4 know -- then we have the data from the water modeling
5 to apply to, and we know how long they were there, so
6 yes.

7 Q So essentially that same figure that we
8 looked at, as to how you classify people as exposed or
9 unexposed, would have been used?

10 A I think here the survey participant was asked
11 where they -- where they were, where they -- what --

12 Q Okay.

13 A You know, so where they lived on base, so
14 where they -- you know, whether they were in barracks
15 and where the barracks were. I'm pretty sure we asked
16 those questions. So between the family housing records
17 and what they said in the survey, we could pinpoint to
18 a better extent where they were.

19 But the internal -- the case -- the nested
20 case-control sample was done precisely for this
21 purpose. My understanding is when we were comparing
22 Camp Pendleton and Camp Lejeune straight up, we were
23 using all the people, not taking a sample. It's not a
24 case-control sample. Okay? So I think that that's --
25 my memory is that that's probably what we did because

1 it made sense. You have a smaller group of people you
2 have to evaluate when you do a case-control sample, and
3 it's still as good as if you had gotten everybody in.
4 That's the beauty of that kind of approach.

5 Q Okay. So stepping back a little bit --

6 A Okay.

7 Q -- instead of making assumptions based on
8 married or unmarried, you would have used, actually,
9 the information they gave you on the form?

10 A Yes. If they provided it, right, yeah. Yes.

11 Q And what happens if they didn't provide the
12 information?

13 A Then we would have to use other --

14 Q Other assumptions?

15 A Yeah, other assumptions. We may have to use
16 what we did in 2014. We would look at the family
17 housing records and see if they matched this person, if
18 we could make any -- you know, so on and so forth.

19 Q And based on, you know, the -- those
20 determinations and the time that they lived at
21 Camp Lejeune, you assigned separate cohorts into low,
22 medium, and high exposure?

23 A I think so, yeah. Yes. I'd have to look at
24 the tables, but I think that's what we did. Yeah, low,
25 medium, and high.

1 Q Okay. On page 20 of the study --

2 A Uh-huh.

3 Q -- at the last paragraph, you say,
4 "Self-reported cancers and other diseases of interest
5 were confirmed by medical records, cancer registry
6 information, or death certificates." Do you see that?

7 A Yes.

8 Q So if you did not have a HIPAA release, were
9 there other ways to confirm self-reported cancers?
10 Could you use the cancer registry information to do so?

11 A I think that we'd have to have the HIPAA to
12 do that --

13 Q Okay.

14 A -- my recollection. First of all, it wasn't
15 like the cancer incidence study where we had a
16 relationship -- we formed a relationship with all the
17 cancer registries. And you would have had to have done
18 that here. People were diagnosed all over the country.

19 So I'm not sure how we used cancer registry
20 data. I think there were some cancer registries that
21 participated, and I can't remember how many. They may
22 be mentioned in here.

23 Q Yeah, there's a statement in the report that
24 you had approval from 13 cancer registries, covering
25 60 percent of the cancers in the study.

1 A Yeah, so we may have asked the cancer
2 registry, "This person X said they have kidney cancer.
3 Do you have a record in your registry?" So we may have
4 done it that way.

5 We didn't do what we did in the cancer
6 incidence study, where we sent all the DMDC data -- or
7 the whole cohort to every registry to match. Okay? So
8 it would have been individual by individual.

9 Q Okay. Do you have -- do you know what
10 percentage of self-reported cancers or other diseases
11 were confirmed?

12 A Well, I thought these -- that other sentence,
13 we said 40 to 50 percent couldn't be confirmed.

14 Q Okay.

15 A I don't know. I'd have to go look through
16 this report. I haven't looked at this in many years.
17 And because we didn't really want to emphasize this
18 report because of the limitations, it's hard for me --
19 I'd have to look it through.

20 Q Okay. Okay.

21 A There may be a -- there may be a table that
22 actually tells you this, and that's what I'm wondering.
23 I'd have to read the survey. I don't see it, so I'd
24 have to --

25 Q Okay.

1 A -- look harder for it.

2 Q That's okay.

3 I want to focus on the five diseases that
4 we've been focusing on, which are kidney cancer,
5 bladder cancer, NHL, leukemia, and Parkinson's disease.
6 And the first four -- kidney cancer, bladder cancer,
7 NHL, and leukemia -- were identified as sufficient
8 evidence of causation in the study we just looked at
9 earlier, the 2017 ATSDR assessment, right?

10 A Right.

11 Q Parkinson's was classified as equipoise and
12 above, right?

13 A Right.

14 Q Now, if you look at Table 6 in this
15 particular study --

16 A Which -- the survey?

17 Q The survey.

18 A We're still at the survey?

19 Q Yes.

20 (Discussion off the written record.)

21 THE WITNESS: Do you know where it
22 starts?

23 MS. GREENWALD: It's on page 74.

24 MR. BAIN: Page 74.

25 THE WITNESS: Because before that,

1 there's a summary table. Okay.

2 Q (By Mr. Bain) So at least this one compares
3 the odds ratios, comparing cancers and other diseases
4 among Camp Lejeune Marines with those at
5 Camp Pendleton.

6 A Uh-huh.

7 Q If you look at Table 6, comparing the
8 Camp Lejeune Marines and the CCamp Pendleton Marines,
9 of those five diseases that we've been focusing on,
10 only bladder cancer has an odds ratio above 1.5 at
11 1.64?

12 A Uh-huh.

13 Q Is that right?

14 A Yes.

15 Q And turn back a page -- to page 72. And
16 you're looking at the Camp Lejeune Marine high-exposure
17 subcohort and the Camp Pendleton cohort. The odds
18 ratio for bladder cancer drops below 1 to .9. Do you
19 see that?

20 A Yes. Yes.

21 Q Looking back at Table 6, the odds ratios for
22 leukemia and Parkinson's disease were below 1. Do you
23 see that?

24 A Say that again. Sorry. Parkinson's disease
25 was less than 1. And what was the other one?

1 Q Leukemia.

2 A Yes.

3 Q And that means that there's a higher
4 percentage of these diseases in the Camp Pendleton
5 cohort compared to Camp Lejeune?

6 A In the survey, yeah.

7 Q In the survey, right.

8 A Yes.

9 Q The odds ratio for lymphomas, you don't have
10 a breakdown here of non-Hodgkin's. It's just
11 classified all as "lymphomas." Do you see that?

12 A Yes.

13 Q It's slightly over 1 at 1.06, right?

14 A Right.

15 Q And the odds ratio for kidney cancer is 1.31.
16 Do you see that?

17 A Yes.

18 Q There were higher odds ratios in the survey
19 above 2 for cancers that are not referenced in the 2017
20 ATSDR's assessment of the evidence as sufficient or
21 equipoise and above, such as you see pancreatic cancer
22 is at 2.26?

23 A Where is -- oh, there it is, up here. Okay,
24 yes, 2.26. Laryngeal is 2.28. Cervical is 2.01.
25 There's a whole bunch -- again, the problem with

1 this -- what you're seeing probably here is selection
2 bias for some of these. Who knows.

3 Q Okay.

4 A I mean, we don't know. But, yes, there are a
5 number of them, including abnormal sperm, having a
6 high -- and infertility. So a lot of different
7 outcomes here that had higher -- whether these are real
8 or bias is, you know, hard to tell.

9 Q And there were a couple that were
10 significantly below 1, such as scleroderma at .37
11 and --

12 A Right.

13 Q -- ALS at .81, right?

14 A Right, right.

15 Q Which would mean that there were more cases
16 at Camp Pendleton, as reported in the survey, versus
17 Camp Lejeune, right?

18 A Yeah, well, we're talking seven -- yeah,
19 we're talking small numbers of cases.

20 Q Okay.

21 A Oh, that's right. Yeah, right. Yes,
22 because -- I mean, there are less cases at
23 Camp Pendleton than Lejeune in the table, but that's
24 because Pendleton is a smaller group, right.

25 MR. BAIN: I think I'm going to stop

1 right there. I'm in the middle of this
2 report, but I promised the court reporter
3 we'd stop at 5:15.

4 THE VIDEOGRAPHER: Okay. The time is
5 5:13 p.m. Going off the video record.

6 (Deposition adjourned at 5:13 p.m.)
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C E R T I F I C A T E

STATE OF GEORGIA

COUNTY OF COBB

I, MICHELLE M. BOUDREAUX-PHILLIPS, do hereby
certify that DR. FRANK J. BOVE, the witness whose
deposition is hereinbefore set forth, was duly sworn by
me and that such deposition is a true record of the
testimony given by such witness.

I further certify that I am not related to
any of the parties to this action by blood or marriage
and that I am in no way interested in the outcome of
this matter.

IN WITNESS WHEREOF, I have hereunto set my
hand this 21st day of October 2024.



MICHELLE M. BOUDREAUX-PHILLIPS, CCR

ERRATA SHEET FOR THE TRANSCRIPT OF:

Case Name: In Re: Camp Lejeune Water Litigation

Deposition Date: October 17, 2024

Deponent: Dr. Frank J. Bove

Pg.	Ln.	Now Reads	Should Read	Reason
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Signature of Deponent

SUBSCRIBED AND SWORN BEFORE ME

THIS _____ DAY OF _____ 20____.

(SIGNATURE OF NOTARY PUBLIC)

MY COMMISSION EXPIRES: _____

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1968 176:14 1969 187:10,15 1970s 301:1 1972 153:23 154:1 175:8 1973 16:6,13 201:19 1975 198:17,24 1977 17:18 215:14 216:2 1980 59:1 187:2 213:18 213:19 1980s 30:4 179:4 301:1 1982 178:20 1985 176:14 198:17 201:19 1986 28:12 60:4,19 1989 123:17 1991 28:15 123:17 1995 187:11 1:32 146:23 1a 153:3 1st 187:11,15	202:17,20 230:21 258:6 260:6,22 261:1 261:5 265:15 267:22,22 280:15 310:19 2.01. 310:24 2.26 310:22 2.26. 310:24 2.28. 310:24 2.8.2 55:5 2.9 55:10,20 20 7:12 57:13 76:20,23 143:6 183:21,22 193:3 269:10 306:1 314:23 20005 3:24 2001 189:16 2003 266:4 20044 3:19 2005 45:25 46:25 47:3,5 243:4 2006 47:4 2007 241:2 242:5 243:11 244:1 2008 63:25 64:9,21 274:19 2009 43:4 44:3 174:8 291:6 2013 187:13 2014 6:8,9 70:14 101:1	183:23 193:23 265:1 303:10 303:24 305:16 2014a 265:20 2015 107:7,10 111:21 249:20 290:6,9,17,18 2016 77:9 119:8,13,21 121:20 123:5 124:24 138:6 138:19 149:11 249:25 264:9 281:15,15 289:24 290:10 290:16 2017 70:14 104:14,21 121:4,7 137:7 138:4 247:20 290:2,7 308:9 310:19 2018 7:22 15:21 66:13 67:4 294:19 2019 77:9,10 149:12 202.616.4209 3:20 202.616.4211 3:24 2020 162:24 2021 162:24 2022 163:1	2023 5:9 14:9 14:10 134:12 135:1,2 2024 1:17 2:6 8:4 40:13,25 100:25 313:18 314:3 20s 104:5 21 7:15 241:25 242:2 212.558.5500 3:6 219 3:13 21st 313:18 22 7:17 266:15 266:17 23 7:20 261:20 261:21 294:23 294:25 23.3 301:9 241 7:15 24th 3:8 25 301:5 25.2 301:7 250,000 300:22 266 7:17 28th 14:17 294 7:20 29440 3:13 2:41 208:24 2:52 209:2 2nd 243:11
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Federal Rules of Civil Procedure

Rule 30

(e) Review By the Witness; Changes.

(1) Review; Statement of Changes. On request by the deponent or a party before the deposition is completed, the deponent must be allowed 30 days after being notified by the officer that the transcript or recording is available in which:

(A) to review the transcript or recording; and

(B) if there are changes in form or substance, to sign a statement listing the changes and the reasons for making them.

(2) Changes Indicated in the Officer's Certificate. The officer must note in the certificate prescribed by Rule 30(f)(1) whether a review was requested and, if so, must attach any changes the deponent makes during the 30-day period.

DISCLAIMER: THE FOREGOING FEDERAL PROCEDURE RULES ARE PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

THE ABOVE RULES ARE CURRENT AS OF APRIL 1, 2019. PLEASE REFER TO THE APPLICABLE FEDERAL RULES OF CIVIL PROCEDURE FOR UP-TO-DATE INFORMATION.

VERITEXT LEGAL SOLUTIONS

COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

Veritext Legal Solutions is committed to maintaining the confidentiality of client and witness information, in accordance with the regulations promulgated under the Health Insurance Portability and Accountability Act (HIPAA), as amended with respect to protected health information and the Gramm-Leach-Bliley Act, as amended, with respect to Personally Identifiable Information (PII). Physical transcripts and exhibits are managed under strict facility and personnel access controls. Electronic files of documents are stored in encrypted form and are transmitted in an encrypted

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